

# Recovery Plan for *Camissonia benitensis* (San Benito Evening-Primrose)



Cover photographs of Clear Creek Management Area and *Camissonia benitensis* flower used courtesy of Bureau of Land Management, Hollister Office.

Recovery Plan for  
*Camissonia benitensis*  
(San Benito Evening-Primrose)

California/Nevada Operations Office  
U.S. Fish and Wildlife Service  
Sacramento, California

Approved:   
Manager, California/Nevada Operations Office,  
U.S. Fish and Wildlife Service

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<http://www.fws.gov/pacific/ecoservices/endangered/recovery/plans.html>

- or -

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## EXECUTIVE SUMMARY

**Current Status:** Threatened. *Camissonia benitensis* (San Benito evening-primrose) is a small ephemeral annual plant that occupies a fragile and geologically transitory habitat. *Camissonia benitensis* is known from 53 suboccurrences (mapped sites) that are clustered into 27 occurrences; four of these suboccurrences are sites where *Camissonia benitensis* was introduced. Only a fraction of the suboccurrences support primrose populations in any given year, and most of these populations are small (under 100 individuals). About two-thirds of the occurrences have been adversely affected by off-road vehicle recreation.

The core area for the species consists of habitat within Clear Creek Canyon. This watershed is central to the recovery of the species, because it contains 70 percent of the occurrences managed by the Bureau and about 75 percent of the total number of individuals of *Camissonia benitensis*.

**Habitat Requirements and Limiting Factors:** *Camissonia benitensis* is limited to serpentine-derived alluvial terraces and deposits near San Benito Mountain, southern San Benito County and western Fresno County, California. Over geologic time, floods wash old terraces away and new terraces form elsewhere from the cycle of natural soil erosion, flooding, and deposition processes. One hundred years of mining activity elevated erosion rates above normal levels. Currently, a principal threat to *Camissonia benitensis* is habitat damage and erosion resulting from the recreational use of off-highway vehicles (OHVs) in the Clear Creek Management Area which is managed by the Bureau of Land Management (Bureau).

**Recovery Priority Number:** 5, per criteria published in the Federal Register (U.S. Fish and Wildlife Service 1983). The priority number indicates that *Camissonia benitensis* is a full taxonomic species with a high degree of threat and a low recovery potential (see Appendix A).

**Recovery Objective:** The short-term objective for the recovery of this species is to eliminate or reduce current threats to all existing populations and potential habitat so that the species retains threatened status and does not have to be reclassified as endangered. The long-term objective is to delist the species.

### **Delisting Criteria:**

1. Research has been completed and delisting criteria 2 – 4 have been refined. Factors to be studied include:

- a) Natural rate of habitat replacement (excluding human-caused activities);
  - b) Ecology of *Camissonia benitensis* seedbanks; and
  - c) Population modeling.
2. Known occurrences and sufficient additional suitable habitat, within each watershed unit throughout its range, are protected from direct effects from OHV use and other recreational activities. Appropriate levels of compliance with use regulations by recreationists have prevented adverse impacts to *Camissonia benitensis* suboccurrences and habitat.
  3. Currently occupied and suitable habitat for the species has been restored and maintained over an appropriate period of time, as informed by monitoring and research.  
Given current knowledge, we expect that the “appropriate period of time” will be no less than 20 years. Because the number of individuals in a suboccurrence fluctuates widely from year to year, more emphasis should be placed on maintaining the habitat that supports known suboccurrences. Disturbance and erosion rates should not be substantially elevated above natural levels, and *Camissonia benitensis* should persist in suitable habitat.
  4. Population sizes have been maintained over a 20-year period during a normal rainfall cycle (i.e., includes periods of drought and wet years).
  5. A post-delisting monitoring plan for the species has been developed.

**Criteria for Reclassification to Endangered:**

1. Habitat condition within currently occupied or suitable habitat shows a substantial decline; or
2. Population sizes decline over a 20-year period that includes multiple rainfall cycles (successive periods of drought and wet years); or
3. The incidence of noncompliance with OHV restrictions in *Camissonia benitensis* habitat within the Clear Creek Management Area fails to improve as the amended CCMA Management Plan is implemented.

**Actions Needed:**

1. Protect known occurrences and suitable habitat for *Camissonia benitensis* throughout its range in the CCMA.
2. Reduce or eliminate soil erosion and stream sedimentation above natural baseline levels in watersheds that support habitat for *Camissonia benitensis* and other special status species in the CCMA.
3. Develop and implement a species management plan, including monitoring, for *Camissonia benitensis* to ensure that we have sufficient information on its life history and ecology in the CCMA.
4. Establish an *ex situ* (off-site) seed collection as a hedge against extinction and as a source of seed for introduction efforts.
5. Develop and implement a public awareness program to conserve *Camissonia benitensis* and its habitat.

**Time to Recovery:** Recovery of the species requires implementation of recovery actions and fulfillment of all recovery criteria. Research is needed on the potential for restoration of eroded serpentine terrace habitat. If such restoration proves to be feasible, monitoring of restored plant habitat and plant population levels should be continued over at least 20 years to meet recovery criteria. Given current knowledge about the extent of soil structure alteration (e.g., destruction of some natural surface crusts that form on the soil surface and function to reduce surface erosion rates), as well as altered erosion regimes, the amount of time we believe necessary to achieve restoration and enable delisting may be 50 years. The recovery criteria should also be reassessed pending results of research on seed bank dynamics and population modeling.

**Estimated Cost of Recovery:** \$778,000 plus additional undetermined costs for the first 5 years. Additional costs will be incurred in future years; projected costs over 50-year timeframe are \$2,438,000 plus additional undetermined costs.

Costs, in thousands of dollars:

Year	Action 1	Action 2	Action 3	Action 4	Action 5	Total
1	174	12	10	2	7	205
2	84	12	18	2	20	136
3	74	22	36	2	11	145
4	79	22	36	2	11	128
5	79	19	31	2	11	142
5 Year Total	490	87	131	10	60	778
50 Year Projection	1,340	402	131	10	555	2,438

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# **I. INTRODUCTION**

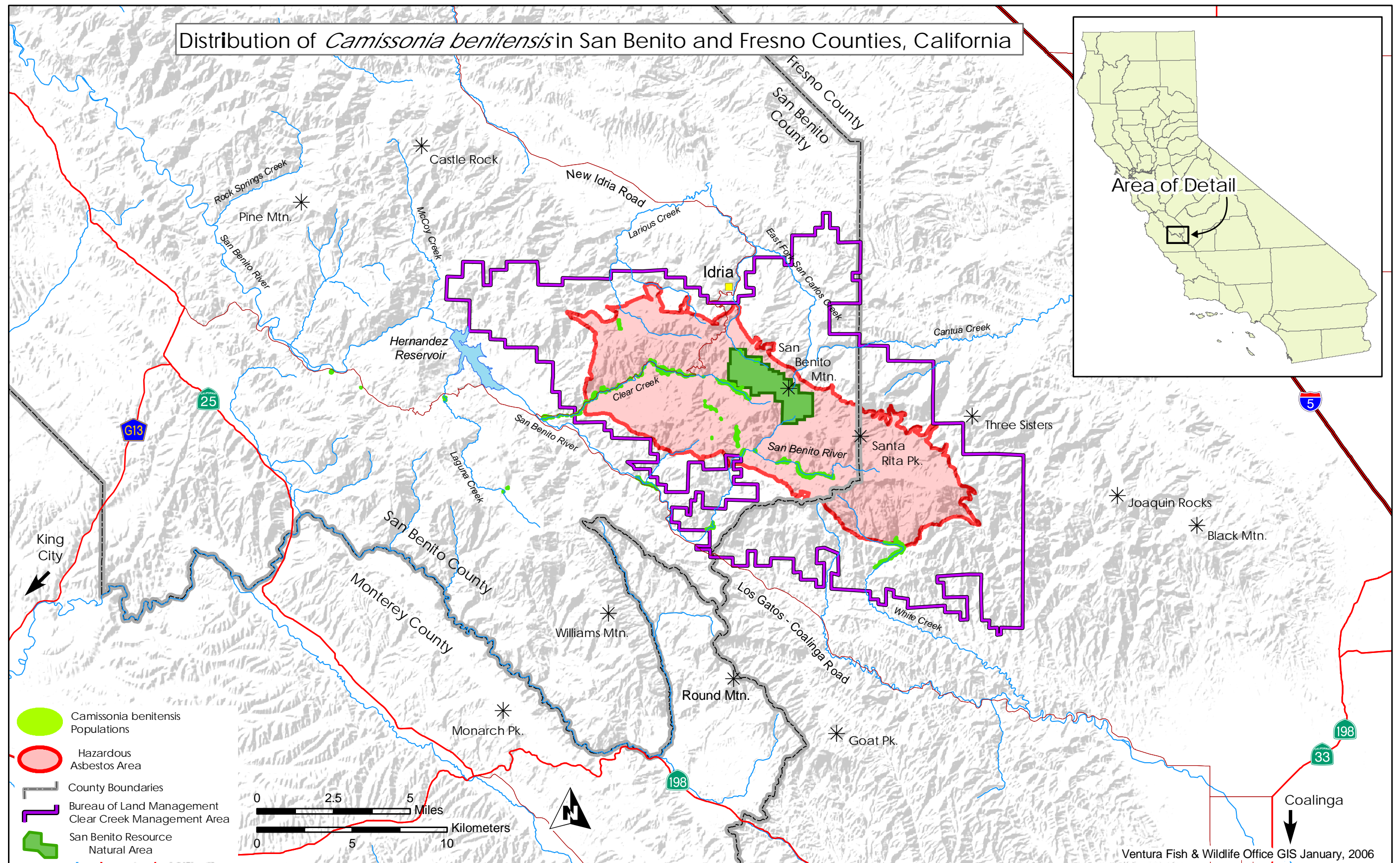
## **A. OVERVIEW**

*Camissonia benitensis* (San Benito evening-primrose) (Raven 1969) is a small, yellow-flowered, annual herb in the four o'clock family (Onagraceae). It is restricted (endemic) to serpentine alluvial deposits in San Benito and Fresno Counties, California (see Figure 1). Of the 27 known occurrences, 20 are entirely and 2 are partially on lands administered by the U.S. Bureau of Land Management (hereafter, Bureau).

Off-highway vehicle (OHV) recreation was identified as the principal threat to the species and the local ecosystem as early as 1970 (U.S. Bureau of Land Management 1970). We proposed to list *Camissonia benitensis* as an endangered species on October 31, 1983 (U.S. Fish and Wildlife Service 1983), based on the threat from motorized recreation. Additional threats included road construction and maintenance, other recreational activities (camping, gem hunting, prospecting), gravel mining, prospecting with bulldozers, vandalism, and environmental stochasticity (randomly occurring natural events). The small number of individuals in each population and the cumulative impacts of threats make long-term viability of this species uncertain.

In recognition of protective measures proposed by the Bureau, we listed *Camissonia benitensis* as a threatened, rather than endangered, species on February 12, 1985 (U.S. Fish and Wildlife Service 1985). However, the status of the species still remains tenuous. *Camissonia benitensis* has a recovery priority of 5. Recovery priorities for listed species range from 1 to 18, with 1 being the highest priority. A priority of 5 indicates a full taxonomic species facing a high degree of threat and a low potential for recovery (see Appendix A).

Until 1996, the Bureau focused its protective measures, primarily the construction of fencing, on areas close to designated camping sites, around OHV recreational



**Figure 1.** Distribution of *Camissonia benitensis* in San Benito and Fresno Counties

play areas, and along OHV trails (Taylor 1995). In 1996, the Bureau expanded its management focus from occupied habitat to potential habitat (U.S. Bureau of Land Management 1997a). At the same time, the Bureau expanded its efforts to control erosion to the watershed scale (Pacific Watershed Associates 1995), in order to reduce the threats to *Camissonia benitensis*. Additionally, in 1996-1997, during its consultation with us pursuant to section 7(a)(2) of the Endangered Species Act, the Bureau proposed key protective measures such as ongoing systematic inventory and user compliance monitoring programs. The Bureau identified enforcement measures that would be implemented if non-compliance by OHV users increased (U.S. Fish and Wildlife Service 1997).

In January 2006, the Bureau adopted the Record of Decision for the Clear Creek Management Area (CCMA) Resource Management Plan Amendment and Route Designation. The amendment included modifications to route and barren designations, implementation of dry season and wet condition closures, improved monitoring, and other significant resource protection advancements. As described later in this document, we completed Endangered Species Act section 7 consultation on the plan amendment.

A substantial body of information detailing the distribution, population, habitat, status and voucher history for *Camissonia benitensis* is found in Taylor's initial report (1990) and subsequent progress reports to the Bureau (Taylor 1991, 1993, and 1995) and annual reports prepared by the Bureau (U.S. Bureau of Land Management 1993, 1994, 1997a, 1997b, 1998, 1999a, 2000, 2001, 2002a, 2003, 2004a, 2005a, and 2006b).

We published a Draft Recovery Plan for this species on February 2, 1999 (U.S. Fish and Wildlife Service 1998, 1999). Comments from peer reviewers and the Bureau have been considered during the development of this final recovery plan (see Appendix D).

## **B. DESCRIPTION AND TAXONOMY**

Peter Raven (1969) first described *Camissonia benitensis* based on collections made "on serpentine by [a] small stream 5.4 miles from Hernandez on road to New Idria, along Clear Creek" 9 years earlier. *Camissonia benitensis* is a short-lived annual species lacking a cluster of leaves at ground level (a basal rosette). Occasionally, it has clusters of several linear villous (covered with soft, fine, unmatted hairs) leaves near the base of its wiry stem, which typically attains a height of 3 to 20 centimeters (1.5 to 8 inches). The purplish-green herb produces many secondary branches at right angles to the main stem. The inflorescences (branches with flowers) are covered with glandular-pubescent and villous hairs. The flowers are nodding when they are open and, like most *Camissonia*, they open near sunrise and generally close by mid-day. Several species in the *Camissonia* genus have retained the common name evening-primrose as a holdover from when this genus was separated out from the closely-related evening-primrose genus *Oenothera*. Although the flowers are bright yellow with occasional red dots at the base of each petal, the species can be cryptic during inclement weather when its flowers frequently remain closed.

The fruit consists of a 4-chambered cylindrical capsule up to 4 centimeters (1.6 inches) long; the tiny seeds form a row in each chamber. Taylor (1990) observed that most plants only produce 1 capsule per plant, though some produced as many as 10. In garden-grown plants, each capsule held an average of 95 seeds. *Camissonia benitensis* produces two types of seeds: black-colored seeds are produced earlier in the season and represent the bulk of the seed, and blond-colored seeds are produced later in the season.

*Camissonia benitensis* can be distinguished from two other *Camissonia* species (*Camissonia strigulosa* and *Camissonia. contorta*) that overlap its distribution on the basis of a number of characteristics, including petal length, the type of hairs on the hypanthium, and the timing of flowering. Additional descriptions and a dichotomous key to distinguish the *Camissonia* and *Oenothera* species in the Clear Creek Management Area (CCMA) are available in a report by Taylor (1990) on the ecology and life history of *Camissonia benitensis*.

## **C. HABITAT/ECOSYSTEM**

### **1. Climate**

Climatic data are lacking for Clear Creek Canyon, where most of the populations of *Camissonia benitensis* occur. However, nearby weather stations can provide inferences about the general climate: annual rainfall historically averaged 40.4 centimeters (15.9 inches) in Idria (on the northern CCMA boundary), and 41.5 centimeters (16.3 inches) in Hernandez (on the western CCMA boundary) (WorldClimate 2002) (See Figure 1 for locations). The nearest currently active weather station with complete coverage during the past 20 years is in Priest Valley, Monterey County (National Climatic Data Center 2006). . The 60-year average annual rainfall at the Priest Valley weather station is 52.3 centimeters (20.6 inches). Most of the rainfall occurs between December and March, and snowfall is infrequent. Temperatures can range from a minimum of -6.7 to -1.1 degrees Celsius (20 to 30 degrees Fahrenheit) in the winter to 32.2 to 37.8 degrees Celsius (90 to 100 degrees Fahrenheit) in the summer (Taylor 1990). Low annual rainfall coupled with hot summer temperatures limit the growing season for plants.

### **2. Serpentine Soils and Geology**

Serpentine rock is geologically rare and is characterized by high concentrations of magnesium and iron. The substrate for most of the distribution of *Camissonia benitensis* is the largest serpentine formation in the southern Coast Ranges (Jennings 1977), the San Benito serpentine body. It ranges in elevation from 800 to 1,600 meters (2,650 to 5,241 feet) and "extends around San Benito Mountain as a 6.5 by 21 kilometer (4 by 13 mile) oval along the main Diablo Range Divide in San Benito and Fresno Counties" (Griffin 1984).

The San Benito serpentine body covers about 12,140 hectares (30,000 acres) on public land administered by the Bureau within its 30,687 hectare (75,829-acre) CCMA planning area. Within the planning area, 25,575 hectares (63,197 acres) are owned by the Bureau, 795 hectares (1,964 acres) by the State of California, and 4,317 hectares (10,668 acres) by private landowners. Access to the area is

provided by Clear Creek Road, which crosses the creek bed several times, and Spanish Lake Road, which follows the Diablo ridgeline. West of San Benito Mountain at Laguna Mountain and Hepsedam Peak, smaller serpentine bodies and related erosional land surfaces support small disjunct (geographically separated) occurrences of *Camissonia benitensis* and other serpentine endemic plants on private lands and Bureau lands. Because soils developed from the San Benito serpentine body contain high levels of free asbestos fibers that pose human safety hazards, the Bureau designated the 12,140 hectares (30,000 acres) of serpentine within the CCMA as an Area of Critical Environmental Concern (ACEC) in 1984. The Environmental Protection Agency has also designated this same area as a Hazardous Asbestos Area.

Over 150 different minerals can be found in the CCMA; some of these, such as benitoite, can be found nowhere else on earth. Some, such as chromite, cinnabar (mercury ore), magnesite, and asbestos, have been commercially mined from this area in the past. The last commercial asbestos mine within the CCMA closed in 2002. Other minerals, such as jadeite, tremolite, topzite, and neptunite, attract rock hounds to the CCMA (U.S. Bureau of Land Management 2002).

Plant ecologists have studied serpentine soils and vegetation since the early 1940s. Serpentine soils, although generally rich in magnesium, iron, and silica, contain low levels of calcium. Moreover, these soils typically contain heavy metals (e.g., chromium, nickel, cesium, and mercury) and have concentrations of molybdenum, nitrogen, phosphorus, and potassium inadequate for normal plant growth (Kruckeberg 1984). The soils are iron-rich, with montmorillonite clay. They are heavy, retain moisture, and are highly erodible (Kruckeberg 1984). Water moving between silica layers of the clay minerals causes considerable expansion, creating a crust on the soil surface that normally protects serpentine soils from erosion. In the CCMA, the hot summer temperatures and short growing season for plants limits the amount of organic material that is produced and the extent to which the soils in the area develop an enriched A horizon.

Non-serpentine soils also occur in the CCMA. Soils derived from marine sedimentary formations, including Franciscan sandstones and shales, are directly adjacent to the serpentine bodies. At some locations (Picacho Meadow (sub

#271100), Jade Mill (sub #251100), and the Administration site (sub #191000)), *Camissonia benitensis* is found in areas where these other soil types interface with serpentine soils.

The serpentine soils that have developed on stream terraces are notably richer in organic material than the barren serpentine slopes that uniquely characterize the region. The terrace soils are well drained, gravelly-to-sandy, moderately deep, and apparently take a long time to develop (Taylor 1990).

### 3. Serpentine Flora

Serpentine soils, including those of the Clear Creek area, are toxic to most of California's flora, preventing many annual herbs, notably introduced annual grasses, from growing successfully. Thirteen percent of the endemic plants of California are restricted to serpentine, a habitat type occurring on less than 1.5 percent of California's land mass (Safford et al. 2005). Serpentine-tolerant plants confined to ultrabasic substrates, like *Camissonia benitensis*, are referred to by Kruckeberg (1984) as Group III plants. Such species are generally herbaceous, narrow endemics that persist on these unique soils where the more competitive plants of non-serpentine soils are absent. Although Group III plants can be grown on non-serpentine soil, they cannot compete with the more-aggressive, serpentine-intolerant species.

The flat to gently sloping, gravel-covered, alluvial serpentine terraces and debris flows where *Camissonia benitensis* occurs support other plant life. In suitable areas with intact soils, two serpentine endemics, *Eriogonum covilleum* (Coville's buckwheat) and *Streptanthus brewerii* (Brewer's jewelflower), can be found in low densities during years of high rainfall. Serpentine chaparral is the dominant vegetation on scattered barrens throughout the CCMA in general, though usually not on the terraces. Shrubs, such as *Adenostoma fasciculata* (chamise), *Ceanothus cuneatus* (buckbrush), *Quercus durata* (leather oak), *Arctostaphylos glauca* (bigberry manzanita), and *Arctostaphylos pungens* (Mexican manzanita) grow with *Camissonia benitensis* on the alluvial terraces and more abundantly on the surrounding slopes (Taylor 1990).

Patches of a unique forest type are scattered within the chaparral in the CCMA. Components of this unusual plant community include four conifer species known to co-occur only at this location. Serpentine indicator species, *Pinus jeffreyi* (Jeffrey pine) and *Calocedrus decurrens* (incense cedar), along with *Pinus coulteri* (Coulter pine) and *P. sabiniana* (gray pine), thrive here. *Pinus jeffreyi*, typically a Sierra-Nevada and Transverse Range species, and *Pinus coulteri* form a rare hybrid, also known only from this location. The dominant understory vegetation includes the serpentine endemic *Quercus durata*, *Quercus berberidifolia* (scrub oak), *Arctostaphylos glauca*, *Arctostaphylos pungens*, *Garrya congdonii* (Congdon's silk tassel), and several other species (Taylor 1990).

#### 4. Topography

Gently sloping ridges and interfluvies (upland areas between streams) dominate the topography of the area. The highest point in the CCMA is San Benito Mountain, which rises to 1,599 meters (5,247 feet) in elevation. Higher order perennial streams descend from San Benito Mountain and drain the watersheds. Clear Creek flows to the west until it discharges into the San Benito River; Larios and San Carlos Creeks flow to the north where they discharge into Silver Creek. White Creek descends from Wright Mountain and flows to the southeast.

Closer to the stream channels, the slopes become steep and planar (Dynamac Corporation 1998) with small and well-defined stream terraces. The terraces where *Camissonia benitensis* occurs have elevations of 600 to 1,370 meters (1,200 to 4,500 feet) (Tibor 2001; J.A. Delgado, pers. comm., 2002).

The serpentine alluvial flats, terraces, and debris flows (alluvial outwash) in San Benito and Fresno Counties adjoining San Benito, White, Laguna, Larios, Clear, and San Carlos Creeks, as well as an unnamed tributary to the San Benito River downstream of its confluence with Lorenzo Vasquez Creek, and Lorenzo Vasquez Canyon are the only known habitats for *Camissonia benitensis*. Most of the *Camissonia benitensis* populations occur on the relatively more stabilized alluvial flats and terraces, and most of these areas have been surveyed for *Camissonia benitensis*. However, some populations, including some of those at Larios and

Sawmill creeks, upper Clear Creek Canyon, and Upper San Benito River, are at the base of slopes where there is a greater potential for deposition of material moving from above (debris flows). No thorough survey of debris flows in the area has been conducted.

In 1998, *Camissonia benitensis* was observed growing within trail and road treads (3 occurrences), on compacted soils of campgrounds (4 occurrences), and on year-old sediment deposits (2 occurrences) (U.S. Bureau of Land Management 1997a, 1998). Individual plants may occasionally appear in sites that support sub-optimal conditions in favorable years, as in 1998. Many factors could contribute to such an event, including sheetflow and deposition of seed downhill from an existing occurrence during heavy rains. Additionally, seed may germinate and grow in these marginal sites for a year or two, but they may not lead to the establishment of a population if habitat is not suitable in the long term.

## 5. Associated Species

*Camissonia benitensis* occurs with a sparse cover of woody vegetation and herbaceous vegetation (Taylor 1990) and a large proportion of bare ground. A study of associated species identified six annual herbs that together are indicators for suitable habitat: *Cryptantha micromeres* (popcorn flower), *Erodium cicutarium* (filaree), *Eschscholzia californica* (California poppy), *Malacothrix floccifera* (wooly malacothrix), *Lotus subpinnatus* (deerweed), and *Vulpia microstachys* (Nuttall's fescue). The only non-native species is *Erodium cicutarium* (Taylor 1990).

High quality (pristine) sites have a rich species diversity of native annual herbs (35 to 45 species). Other species that frequently occur on terraces with and without *Camissonia benitensis* are *Eriogonum covilleianum* (Coville's buckwheat), *Epilobium minutum* (minute herb-willow), *Mimulus fremontii* (Fremont monkeyflower), *Cordylanthus rigidus* (bird's-beak), and *Linanthus ambiguus* and *Linanthus parviflorus* (linanthus) (Taylor 1990; J. Delgado, pers. comm. 2002).

## 6. Other Sensitive Species in the CCMA

The CCMA supports 25 species of concern (species listed as endangered or threatened by the State, or recognized by the California Natural Diversity Data Base or the Bureau). Some sensitive plant taxa, such as *Layia discoidea* (rayless layia), are of concern to us and the Bureau because their distributions, like *Camissonia benitensis*, are restricted to serpentine substrates in only a few locations. For instance, *Layia discoidea* is known from approximately 20 locations, most of which are within the CCMA. *Fritillaria viridea* (San Benito fritillary), another serpentine endemic, is known from only 6 locations, half of which are in the CCMA.

The California Native Plant Society Inventory (Tibor 2001) includes 12 additional rare, endangered, or vulnerable plants known to occur in the San Benito Mountain region. These plant species are listed in Table 1.

Several sensitive wildlife species also occur within the CCMA (see Table 2). Several of these, including the foothill yellow-legged frog (*Rana boylei*) and the southwestern pond turtle (*Clemmys marmorata pallida*), are aquatic species that depend on riparian habitat and adjacent uplands for at least a portion of the year. Activities that increase erosion and sedimentation rates within stream channels would potentially have adverse effects upon these taxa.

Southeast of Santa Rita Peak in the eastern end of the CCMA are Spanish Lake and a series of vernal pools. Several species of fairy shrimp occur in these pools, including three species that are federally listed as threatened or endangered. The Bureau prohibited OHV recreation in the area as of 1997 (U.S. Fish and Wildlife Service 1997), and partial barriers were constructed to protect the pools in 2004. This should reduce the adverse effects of OHV recreation that could decrease the quality of fairy shrimp habitat through sediment erosion into the pools, or through breaking the underlying hardpan, thus compromising the ability of the pools to retain water.

This recovery plan does not include separate conservation goals for these sensitive species found in the CCMA. However, by recognizing the importance

**Table 1.** Other Sensitive Plant Taxa that Occur in the CCMA

Species Common Name	Scientific Name	Serpentine Substrate	Federal Status <sup>1</sup>	CNPS Status <sup>2</sup>
Rayless layia	<i>Layia discoidea</i>	Yes	BLMS	1B
Slender pentachaeta	<i>Pentachaeta exilis</i> ssp. <i>aeolica</i>	No	BLMS	1B
San Benito thornmint	<i>Acanthomintha obovata</i> ssp. <i>obovata</i>	Yes	BLMS	4
South Coast Range morning-glory	<i>Calystegia collina</i> var. <i>venusta</i>	Yes	BLMS	4
San Benito spineflower	<i>Chorizanthe biloba</i> var. <i>immemora</i>	Yes	BLMS	1B
Talus fritillary	<i>Fritillaria falcata</i>	Yes	BLMS	1B
San Benito fritillary	<i>Fritillaria viridea</i>	Yes	BLMS	1B
Mt. Diablo phacelia	<i>Phacelia phacelioides</i>	Yes	BLMS	1B
San Benito monardella	<i>Monardella antonina</i> ssp. <i>benitensis</i>	Yes	BLMS	4
Serpentine linanthus	<i>Linanthus ambiguus</i>	Yes	-	4
Western Heermann's buckwheat	<i>Eriogonum heermannii</i> var. <i>occidentale</i>	No	BLMS	4
Santa Clara thornmint	<i>Acanthomintha lanceolata</i>	Yes	BLMS	4
Carlotta Hall's lace fern	<i>Aspidotis Carlotta-halliae</i>	Yes	BLMS	4

<sup>1</sup> BLMS = designated as a Bureau sensitive species.

<sup>2</sup> CNPS Status: 1B = meets the criteria for state listing; 4 = plant of limited distribution.

**Table 2.** Sensitive wildlife species that occur in the CCMA.

Species Common Name	Scientific Name	Federal Status <sup>1</sup>	State Status <sup>2</sup>
Foothill yellow-legged frog	<i>Rana boylei</i>	BLMS	
Southwestern pond turtle	<i>Clemmys marmorata pallida</i>	BLMS	SOC
Two-striped garter snake	<i>Thamnophis hammondi</i>	BLMS	SOC
Coast horned lizard	<i>Phrynosoma coronatum frontale</i>	BLMS	SOC
Long-eared bat	<i>Myotis evotis</i>	BLMS	
Long-legged bat	<i>Myotis volans</i>	BLMS	
Yuma bat	<i>Myotis yumanensis</i>	BLMS	
Greater western mastiff-bat	<i>Eumops perotis californicus</i>	BLMS	
Bell's sage sparrow	<i>Amphispiza belli belli</i>	BLMS	
Conservancy fairy shrimp	<i>Branchinecta conservatio</i>	FE	
Longhorn fairy shrimp	<i>Branchinecta longiantenna</i>	FE	
Vernal pool fairy shrimp	<i>Branchinecta lynchi</i>	FT	

<sup>1</sup> Federal Status: BLMS = designated as a Bureau sensitive species; FE = federally endangered; FT = federally threatened.

<sup>2</sup> State Status: SOC = designated by the California Department of Fish and Game as a species of concern

of maintaining the integrity of watershed units for the long-term conservation of *Camissonia benitensis*, we intend for management actions to contribute to the long-term conservation of sensitive species that share the same geographic area.

## 7. Suitable Habitat

In the Clear Creek Management Area, Taylor (1990) inventoried 53 alluvial terraces (the majority of the potential habitat for *Camissonia benitensis*) for habitat suitability. The three suitability criteria were: 1) less than 50 percent of open sites (between shrubs) were disturbed by vehicle traffic, 2) at least 50 percent of the associated species were present on the site, and 3) chaparral covered no more than 25 percent of the site. *Camissonia benitensis* occupied nine

terraces, and six terraces appeared suitable but unoccupied. The remaining 38 terraces were considered unsuitable as habitat for *Camissonia benitensis* because they did not meet the criteria; 35 of the 38 terraces were over 50 percent disturbed by vehicle traffic. In summary, suitable habitat consists of the following:

- a) Physical characteristics: alluvial terraces or areas adjacent to slopes (alluvial outwash) below an elevation of approximately 1372 meters (4,500 feet). The habitat is flat to gently sloping (less than 3 degrees), on residual serpentine or serpentine alluvium, subject to frost heaving, and with minimal cover of surface gravel.
- b) Biotic characteristics: the association of annual plants as described above in section 5 (Associated Species), and no more than 25 percent of the terrace covered with chaparral.
- c) Habitat stability: the habitat is relatively stable with little soil erosion caused by natural processes (e.g., mass wasting), historical uses (e.g., mining activities), and current uses (e.g., recreational activities). The extent of stable habitat needs to include not only the current area occupied by *Camissonia benitensis*, but also sufficient surrounding habitat for maintaining stable soil and hydrologic processes, and for ensuring the species' ability to migrate within potentially suitable habitat at a site.

## 8. The Potential for Habitat Restoration

Certain terraces that are currently not suitable could be rendered suitable through restoration efforts. As of 1990, nearly two-thirds of the terraces that Taylor inventoried had greater than 50 percent of their surfaces disturbed from vehicle traffic, including roadways, camping, and OHV traffic (Taylor 1990).

Elimination or reduction of these activities from terrace sites would reduce the rate of soil erosion and soil surface disturbance. Curbing traffic would allow extant populations to expand, and make other sites available for natural expansion and reintroduction efforts. Also, some terrace sites that feature otherwise suitable *Camissonia benitensis* habitat, but have more than 25 percent chaparral coverage that does not promote habitat usage, may have the greatest potential for new

suitable habitat for *Camissonia benitensis* (Taylor 1990). Resource managers may be able to reduce chaparral cover in these areas through controlled burning or manual brush removal.

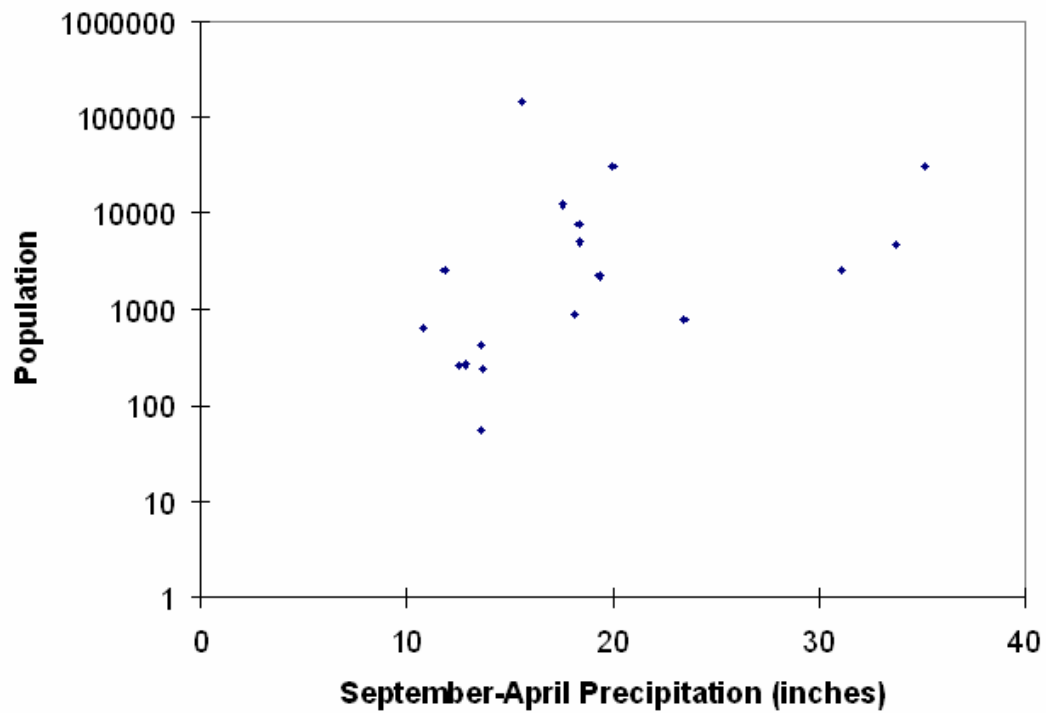
#### **D. LIFE HISTORY/ECOLOGY**

##### **1. Reproduction and Seed Production**

*Camissonia benitensis* was confirmed to be autogamous (self-pollinating) through controlled experimentation (Taylor 1990). Insects or other non-biotic mechanisms (e.g., wind, water) are not required to achieve pollination and development of viable seed. Germination in the field occurs from early February to late March, with most plants germinating from late February to early March (Taylor 1990). Flowering occurs in mid-spring and seed pods are mature by early summer.

The relative productivity of individual plants and occurrences has been assessed through field measurements of numbers of capsules per plant (typically one) and numbers of seeds per capsule (90 to 100). The black-colored seeds germinate more readily than the blond-colored seeds and comprise more than 95 percent of the total seed production (Taylor 1990). Annual germination rates depend on a number of factors, the most important of which may be rainfall. Taylor (1990) observed that the largest population sizes occurred in years with moderate rainfall (80 to 85 per cent of average) and suggested that both very wet and very dry years will result in reduced germination and density of *Camissonia benitensis* individuals.

Examination of population data (1987-2005) shows a positive association between log-transformed population size and October-April precipitation (Figure 2). In particular, all years when total populations were below 1000 individuals (Appendix B) were drought years, with less than 15 inches precipitation at the Priest Valley weather station. (Because precipitation averages are about 30 percent higher at Priest Valley than at Idria and Hernandez, 15 inches of annual precipitation at Priest Valley likely corresponds to somewhat lower precipitation



**Figure 2.** Annual *Camissonia benitensis* population size from 1987-2005, as a function of precipitation (September-April total precipitation in inches, measured at Priest Valley weather station). For comparability, data shown are restricted to suboccurrences discovered prior to 1987; patterns across all known suboccurrences are similar. Based on data from National Climatic Data Center (2006) and Bureau surveys (Appendix B)

in the Clear Creek area; however, the Priest Valley weather station is the nearest one with a continuous long-term record covering the survey period.) Among non-drought years no clear population trend is apparent. The anomalously high population size in the moderately dry year of 1988 complicates interpretation of the trend and suggests that other factors such as site differences, short-term timing of precipitation, or temperature variation may also influence optimal germination conditions. Such extremely favorable years, which may contribute disproportionately to replenishment of the soil seed bank, appear to occur sporadically. Further study of controlling environmental factors could aid our understanding of population fluctuations in this species.

#### Occurrence or Suboccurrence?

Bureau reports from 1996, and this recovery plan, define an occurrence as any *Camissonia benitensis* within 0.25 mile (shortest distance) of any other. This definition resulted in some lumping of groups previously monitored as separate populations. For consistency, these plant groups are recognized as suboccurrences, and the Bureau continues to monitor them separately. A suboccurrence is any group of *Camissonia benitensis* that differed notably in habitat characteristics (slope, aspect, disturbance regime) or geographic location from any other group belonging to the same occurrence (U.S. Bureau of Land Management 1997a).

For many short-lived annual species, maintaining a seedbank in the soil is an important mechanism for surviving years of climatic conditions that are poor for seed germination and seedling survival (Baskin and Baskin 1978). Seedbanks are part of the species' population, even though only the above-ground portion of the population is visible. Soil core samples collected from the top 5 centimeters (2 inches) of soil at sites in Clear Creek (suboccurrence (sub) #51200) and San Carlos (sub #91100), were analyzed for density of germinable seed. The samples yielded a range of 100 to 4,700 seeds per square meter (84 to 3,900 per square yard); this amount is over an order of magnitude larger than the observed density of plants growing at those sites (Taylor 1990). This large soil seedbank suggests that year-to-year fluctuations in population size are largely a function of variation in rainfall and do not necessarily depend heavily on fecundity of plants from previous years (Taylor et al. 1989).<sup>1</sup>

<sup>1</sup> Germination can be inhibited or triggered by factors such as light intensity, photoperiod, temperature, temperature fluctuations, moisture, physical abrasion of the seed coat, chemical influences on the seed coat, and perturbation events such as landslides, flood, or fire. Furthermore,

Taylor et al. (1989) investigated several characteristics of the seed from *Camissonia benitensis*. In the wild, annual seed production is highly variable, with fewer seed being produced in dry years. While most individuals in the wild produce only one capsule per plant, some individuals produce two, three, or as many as ten capsules. Capsule length and the number of ovules per capsule were positively correlated, with the mean capsule lengths of 3 populations ranging from 20 to 27 millimeters (0.02 to 0.027 inches), and ovules per capsule ranging from approximately 30 to 60. When subsequently grown in more favorable garden conditions, seed from two of the three native populations produced plants with capsules reaching lengths of 36 millimeters (0.036 inches) and containing means of 94 and 98 ovules per capsule.

Eighty percent of the second-generation seed produced from these garden-grown plants was viable. Most of the seed produced (96 percent) were the black angular type, while the remaining seed (less than 4 percent) were the smooth blond type. The two types of seed differ in their germination response to different temperature conditions. Black seed germinates faster and more readily than blond seed, and both types of seed germinated more readily at 3 degrees Celsius (37.4 degrees Fahrenheit) than at 20 degrees Celsius (68 degrees Fahrenheit). From this, Taylor et al. (1989) concluded that germination of *Camissonia benitensis* requires some degree of cold stratification during the winter, rather than being triggered only by late fall rains.

## 2. Causes and Rates of Mortality

Seedling survivorship was documented for populations in Clear Creek (sub # 51200, #51100) and San Carlos (sub #91100) (Taylor 1990). Suboccurrence #51200 had 48 percent seedling mortality, suboccurrence #51100 had 73 percent mortality, and suboccurrence #91100 had 83 percent mortality. The majority of the mortalities were attributable to drought; less than a third of the mortalities resulted from predation from plant-eating insects. Ten percent of the mortalities

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there is evidence that the conditions under which seeds are stored (buried) can induce dormancy in seeds that show no dormancy when freshly collected (Silvertown 1987).

resulted from frost-heaving of the soil early in the growing season, which damaged the roots (Taylor 1990).

### 3. Demography

As noted previously, population densities and numbers of *Camissonia benitensis* plants vary greatly over several growing seasons and appear to be largely caused by variation in rainfall patterns, rather than by the amount of seed produced during the previous year. Additionally, the seed that germinates in a given year may have remained in the soil as a seedbank for a number of years. Therefore, long-term seed storage in the soils is essential for the survival of *Camissonia benitensis*. The vulnerability of populations to extirpation may be directly proportional to the depletion of seed reserves by years of chronic disturbance (Taylor 1989).

In years that are favorable to growth and reproduction of *Camissonia benitensis*, more suboccurrences support plants, and the populations are typically larger in size (Rutherford 2003). In less favorable years, fewer populations are visible, and the visible populations are typically smaller in size. Table 3 illustrates, for instance, that in 1999, a poor year, only 39 percent of the suboccurrences supported above-ground plants, with an average population size of 45. In 2000, a good year, 74 percent of the suboccurrences supported plants, with an average population size of 524 individuals.

**Table 3.** Population Demography -Variation in proportion of occurrences with above-ground populations and average number of individuals per population for selected years (from Rutherford 2003).

Year	Number of Suboccurrences Checked	Number of Suboccurrences with Plants	Percent of Suboccurrences with Plants	Total Number of Individuals	Average Number of Individuals per Occurrence
1997	35	26	74	1,606	62
1998	42	39	93	12,843	329
1999	36	14	39	625	45
2000	43	32	74	16,760	524
2001	50	24	48	1,924	80
2002	38	28	74	5,133	183
2003	45	36	80	16,485	458

#### 4. Dispersal

*Camissonia benitensis* may have both short-distance and long-distance seed dispersal mechanisms. For a plant to reproduce successfully, its seeds must be dispersed to sites where they can germinate and establish seedlings. Places where such conditions are met are known as safe sites (Harper 1977). *Camissonia benitensis* safe sites may be available in the immediate vicinity (within a few square centimeters) of the parent plants. Although the short stature of the plants when in fruit (5 to 10 centimeters [2 to 4 inches] tall) provides for short-distance seed dispersal, a population can shift around through adjacent appropriate habitat over a period of several years. Over time, the above-ground population may appear on more of the available habitat than is observed in any single year.

Evidence of long-distance seed dispersal in the long term comes from several sources: the number of suboccurrences separated by perennial streams (six occurrences), and the distribution of occurrences over a large geographic area in a number of watersheds. Mechanisms that could aid in long-distance seed dispersal include wind, sheet runoff, and transport by small vertebrates.

## **E. DISTRIBUTION**

*Camissonia benitensis* is restricted to southeastern San Benito County and extreme western Fresno County in the Central Coast Range of California. Occurrences in San Benito County are distributed over an area about 8 by 32.2 kilometers (5 by 20 miles), with most of the occurrences (14) and individuals along an 8-kilometer segment of the lower portion of the Clear Creek watershed that drains west into the San Benito River (Taylor 1990, 1995; Appendix B). Other occurrences are found in the Laguna Creek and Lorenzo Vasquez Canyon watersheds, which also drain into the San Benito River below Clear Creek Canyon. The most recently discovered occurrences are in Larious Canyon. The Larious Canyon and San Carlos Creek watersheds drain north into the Silver Creek-Panoche Creek watershed. In Fresno County, several occurrences are found along White Creek, which drains southeast into the San Joaquin Valley. Figure 1 shows the general location of the Clear Creek watershed and surrounding geographic features.

To more accurately track the distribution of *Camissonia benitensis*, Taylor (1990) continued and improved a long-standing naming convention of the previously recognized sites/populations. In 1996, the Bureau conducted a baseline inventory to identify potential habitat along with occupied habitat (U.S. Bureau of Land Management 1997a). Bureau reports from 1996 onward, and this recovery plan, define an occurrence of *Camissonia benitensis* as any plant within 0.25 mile (shortest distance) of any other plant. This definition lumped some plant groups that Taylor had monitored as separate populations, including some introduced populations (see section I.F.2 below). For consistency, these plant groups are recognized as suboccurrences, and continue to be monitored separately. A “suboccurrence” is a group of plants that differed notably in habitat characteristics (slope, aspect, disturbance regime) or in geographic location from any other group of plants belonging to the same occurrence (U.S. Bureau of Land Management 1997a). This recovery plan uses the Bureau’s current practice of identifying sites as occurrences and suboccurrences, while restricting the use of population to discussions of population trends, i.e., number of individuals over time for the entire species or for defined subunits.

Another term derived from the Bureau's inventory and compliance monitoring programs for *Camissonia benitensis* is potential habitat polygon. A polygon in this instance is a mapped area (as in a geographic information system) with boundaries that enclose moderate- to high-quality habitat. A polygon of potential habitat includes at least one occurrence, but it may also demarcate unoccupied habitat (U.S. Bureau of Land Management 1997a). "Site" refers non-technically to localities, with or without occurrences.

*Camissonia benitensis* is found in 53 suboccurrences, clustered into 23 natural occurrences and 4 artificially-seeded ones. Table 4 summarizes the distribution of suboccurrences by county and watershed. The Clear Creek and upper San Benito River watersheds can be viewed as the center of distribution for the species and also support the greatest number of occurrences and individuals (see Tables 4 and 5). Adjacent watersheds support fewer occurrences. Outlying occurrences tend to have slightly different habitat conditions from typical serpentine-derived terrace habitat found in the Clear Creek and upper San Benito River watersheds. For instance, some of these suboccurrences appear in geologic zones where serpentine interfaces with Franciscan sandstones and shales. Other outlying suboccurrences (e.g., San Carlos meadow) are at higher elevations than the more typical alluvial terrace along a creek or stream (U.S. Bureau of Land Management 1997a). Evolutionarily, outlying populations are as important to the long-term viability of the species as populations in the center of the species distribution. Outlier populations may have additional genetic material resulting from different ecologic conditions. This variation enables the species to more easily adapt to changing conditions over long periods of time (Lesica and Allendorf 1991, 1995).

**Table 4.** Distribution of *Camissonia benitensis* among counties and watersheds.  
(Data from BLM Hollister Office)

County	Watershed	Number of Natural Suboccurrences	Number of Introduced Suboccurrences
San Benito	Clear Creek	26	4
	San Carlos Creek	2	0
	San Benito River	10	0
	Laguna Creek	2	0
	Lorenzo Vasquez Canyon	2	0
	Larious Creek	2	0
Fresno	White Creek	5	0
<b>Total</b>		<b>49</b>	<b>4</b>

**Table 5.** Annual number of *Camissonia benitensis* individuals in the Clear Creek watershed as a percentage of total population counts. (Note that the number of known occurrences has continued to increase over the years.)

Year	Numbers of Individuals in Clear Creek Watershed	Total Numbers of Individuals	Numbers of Individuals in Clear Creek as a Percent of the Total
2006	60	284	21.1
2005	19,145	41,543	46.1
2004	244	607	40.2
2003	11,773	16,485	71.4
2002	1,342	5,133	26.1
2001	787	1,924	40.9
2000	7,319	16,760	43.7
1999	341	625	54.6
1998	6,637	12,843	51.7
1997	675	1,606	42.0
1996	6,813	10,273	66.3
1995	-	-	
1994	331	878	37.7
1993	2,734	5,092	53.7
1992	29,358	32,208	91.2
1991	5,146	5,207	98.8
1990	133	146	92.0
1989	1,314	1,703	77.2
1988	160,770	165,168	97.3
1987	115	264	43.6
1986	2,840	3,590	79.1
1985	12,218	13,618	89.7
1984	38	68	55.9
1983	770	1,320	58.3
1980	250	250	100.0
1979	0	25	0

## **F. POPULATION STATUS**

Taylor's (1995) inventory of the region, from 1987 to 1994, doubled the number of known occurrences of *Camissonia benitensis*. Inventories in 1996 added seven new suboccurrences (U.S. Bureau of Land Management 1997a). Inventories in 1998 added 4 new occurrences with 16 new suboccurrences (U.S. Bureau of Land Management 1998). The number of individuals in an occurrence or suboccurrence may change dramatically from year to year (see Appendix B). One suboccurrence at Indian Hill (sub #51100) offers a striking example of fluctuations in the course of 2 successive years: from 6,000 plants in 1988, to none in 1989 (Taylor 1993). Precipitation varied from 40 to 225 percent of the normal regional amount during the 10-year monitoring period. Taylor (1995) observed that good growing years appeared to coincide with years of intermediate rainfall (80 to 150 percent of normal rainfall). Before Taylor's work, monitoring of occurrence sizes consisted of placing occurrences in estimated size classes, a technique used by the Natural Diversity Data Base of the Natural Heritage Division of the California Department of Fish and Game. Taylor established quadrats along a line intercept transect and extrapolated plant densities based on the area covered for two of the larger occurrences. Since Taylor's initial work, the Bureau (1997a) has used both direct counts and estimation methods.

A few studies have estimated the viable population size of plant species, defined as the number of plants needed to avoid extinction with a 95 percent probability of persistence for 100 years (Shaffer 1987, Menges 1991). A population size of 1,000 individuals may be adequate for a long-lived perennial species, but annual species may require larger populations (at least 100,000 to 1 million in climatically favorable years) to survive natural perturbation events that can eliminate occurrences and suitable habitat (Thomas 1990). Thus far in the course of monitoring, a maximum of six *Camissonia benitensis* occurrences have had more than 1,000 individuals in any single year (2000, 2005). In many years, no suboccurrences reached this number (1983, 1984, 1987, 1990, 1994, 1997, 1999, 2001, 2004). Whether these population patterns are cause for concern is difficult to determine at this time, because population estimates for an annual species should include viable seeds in the soil, not just above-ground plants (Doak et al.

2002). So far, annual counts and estimates of *Camissonia benitensis* have not included this stage of the species' life cycle.

In addition to seedbank abundance, other seedbank characteristics are important in assessing its contribution to the long-term viability of the species. Information from seedbank studies, the life history of this species, and the requirements for suitable habitat can then be used to develop population models. Population modeling may allow us to compare the risk of extinction under natural rates of habitat replacement (terrace erosion and formation) and the risk under a range of estimated rates of soil damage and erosion under different habitat management scenarios. This information would assist us and the Bureau in making and adjusting management decisions that will promote the long-term conservation of *Camissonia benitensis*.

#### **G. REINTRODUCTION EFFORTS**

Taylor (1991, 1992) attempted establishment of artificial occurrences at four locations in the Clear Creek watershed over a 2-year period. He gathered seed from Indian Hill (sub #51200), the largest known suboccurrence, and cultivated the seed in Aptos, Santa Cruz County, to produce seed for sowing in 4 locations within the CCMA. In the first season only 194 plants resulted from sowing 150,000 seeds. Table 6 summarizes the results of these efforts.

These initial attempts resulted in a very low establishment rate for plants from broadcast-sown seed, although small numbers of plants have continued to be irregularly detected at these sites in subsequent years (Table 6; Appendix B). Additional research would need to be done to determine whether other introduction techniques would result in greater success and how other factors, such as rainfall and weather conditions, could affect results. Reviews of attempts to create self-sustaining occurrences of other rare plants noted that most of those projects have not been successful (Fiedler 1991, Pavlik et al. 1993). Still, for species where reintroduction efforts are deemed warranted, research should proceed with careful thought to appropriate methodology.

**Table 6.** Success rate of seeding attempts (Taylor 1991, 1992).

Population Occurrence	Number of Seeds Sowed	Number of Resulting Seedlings	Success Rate
1C	60,000	147	0.002
7	30,000	28	0.001
16	30,000	16	0.0005
17	30,000	3	0.0001
<b>Total</b>	<b>150,000</b>	<b>194</b>	<b>0.001</b>

## ***H. REASONS FOR LISTING AND CURRENT THREATS***

Reviewing the history of human uses in the CCMA , particularly with respect to mining activity, is useful for understanding the current threats to *Camissonia benitensis*. The New Idria Mining District, which includes most of the Clear Creek Management Area, was established in 1858. Activity peaked in the early 1900s, with most mining focused on mercury-containing chromite deposits and Coalinga chrysotile. Chromite ore extraction continued until 1972. Now, over 100 abandoned historic mines are in the CCMA. By the 1950s, approximately 676 kilometers (420 miles) of primitive roads and trails had been constructed to service mining operations. Historic mining activity affected the CCMA in several ways: miners cut chaparral and oak woodlands to provide fuel for furnaces. Conifers (most likely Jeffrey pine and Coulter pine) were cut to shore up mining tunnels (Griffin and Yadon undated). In addition, the roads and trails contributed to soil erosion and stream sedimentation rates above normal levels. The roads and trails constructed during the historic mining era became the initial trail network for OHV recreation in the CCMA that began in the 1960s (U.S. Bureau of Land Management 2005b).

We listed *Camissonia benitensis* as a threatened species on February 12, 1985 (U.S. Fish and Wildlife Service 1985). At the time of listing, nine occurrences were known, all in either the Clear Creek or San Carlos Creek drainages, and the estimate of the total population was less than 1000 individuals. The final rule stated: “(T)his action is being taken because a significant portion of the limited range of the species is subject to gravel mining and damage by off-road vehicle (ORV) use.” Other factors affecting the species’ continued existence were: (1) the absence of appropriate regulatory authority to provide adequate protection for the species; (2) the species’ moderate reproductive potential; (3) the species’ ability to recover after disturbance is removed; and (4) the meager information available on its life history requirements. The current threats are discussed in following sections.

## 1. Listing Factor A: The Present or Threatened Destruction, Modification, or Curtailment of Its Habitat or Range

### a. Off-Highway Vehicle Recreation

Uncontrolled OHV use has been a substantial threat to *Camissonia benitensis* and its habitat (U.S. Bureau of Land Management 1970, 1981, 1982, 1984, 1986, 1993, and 1995; Losos et al. 1993; Taylor 1990, 1991, 1993, and 1995). The Clear Creek Management Area attracts OHV recreationists in large numbers because its serpentine areas offer open slopes (barrens) for riding (U.S. Bureau of Land Management 2005b), and visitor use in the CCMA has increased over the past decade. In 2004, the Bureau invested in new visitor use counting devices. As a result, and combined with actual onsite counts, visitation figures have been refined. Recent Bureau reports place the current level of use at approximately 50,000 visitor-use days per year (U.S. Bureau of Land Management 2005b).

The effects of recreational use on *Camissonia benitensis* and its habitat differ according to several factors, including the type, the timing, frequency, intensity, and location of use. For instance, OHV use on main roads and certain trails likely has little effect because they are configured in a way that minimizes damage to the terrain. Other types of recreation, such as camping, OHV hill climbing, and

special events, have greater effects. The silt-clay crust that forms on serpentine soils protects open, undisturbed slopes from erosion. When the crust is disturbed, sheet erosion, rilling, and gullying occur (Dynamac Corporation 1998). OHV recreation has caused disturbance of soil integrity, soil loss, compaction of soil, and destruction of plants. In addition, recreation (camping, vehicle traffic and OHV use) has disturbed alluvial terraces in Clear Creek Canyon (BLM 2005b, BLM 2006a). Table 7 summarizes effects of various activities, by type of use; we use the terminology employed by the Bureau's compliance monitoring program

In response to increased visitor use and associated resource concerns, the Bureau initiated management actions to address recreational impacts. For example, in the 1995 Clear Creek Management Plan Amendment and Final Environmental Impact Statement, the Bureau proposed to undertake numerous actions to protect *Camissonia benitensis* and other sensitive species in the CCMA, including: 1) expansion of the San Benito Mountain Natural Area to approximately 1,652 hectares (4,082 acres) and designation as a Research Natural Area; 2) implementing a limited use route, trail, and area designation that would reduce the extent of routes to 434 kilometers (270 miles); and 3) reduce the area of open play (barrens) from 1,618 hectares (4,000 acres) to a maximum of approximately 379 hectares (937 acres). The latter two actions required completing an inventory of existing trails and open play areas, and developing a process for selecting those to remain open (BLM 1995).

Prior to 2006, management of routes and barrens was based on the Clear Creek Management Plan Amendment and Decision Record (U.S. Bureau of Land Management 1995, 1999b) that designated the CCMA as a limited use area and closed use in the existing 800-hectare (2,000-acre) San Benito Mountain Research Natural Area except for the County and ridge route roads. However, the route system was to be managed so as to encourage use on designated numbered and/or signed routes, and to allow use on all other routes which were not physically and/or signed closed, until completion of the route designations in a subsequent environmental analysis. The 2006 amendment to the Clear Creek Management Plan resulted in a large reduction in the amount and extent of open routes and barrens in the CCMA; 389 kilometers (242 miles) of routes and 193 hectares (478 acres) of barrens were designated as open.

**Table 7.** Impacts associated with activities in the CCMA. (compiled from various BLM sources)

<b>Activity</b>	<b>Estimated Actual Extent of Activity within CCMA</b>	<b>Authorized use prior to 2006<sup>a</sup></b>	<b>Authorized use in 2006 Record of Decision on Amendment<sup>a</sup></b>	<b>Type of Impacts</b>	<b>Intensity / Duration</b>
Camping	Throughout CCMA except in San Benito Mtn. Natural Area and certain terraces in Clear Creek Canyon	Authorized	Not Changed in Amendment	compaction of alluvial terrace soils, loss of habitat due to deposition of human wastes and trash	low/ winter season
OHV riding - main trails	Estimate 700 – 1,000 miles of open and unauthorized trails	440 miles of designated open routes	242 miles of designated open routes	increase in soil erosion	high/ winter season; moderate/ year round
OHV riding - roads	Paved/improved roads throughout	29 miles paved/improved roads, included in total above	29 miles paved/improved roads, included in total above	Minor contribution to soil erosion	low-moderate/ year round
OHV riding - open areas on barrens	Estimated 2,876 acres, out of 3,841 acres of barrens on BLM land (BLM 1993)	2,311 acres of designated open play areas on BLM land	478 acres of designated open play areas on BLM land	destruction of plants, increase in soil erosion, increase in deposition on terraces, soil compaction, removal of soil crust in serpentine areas	low to high/ winter season
OHV riding - special events	200-400 visitors per event 3 events/yr	Special use authorizations	Not Changed in Amendment	destruction of plants, increase in erosion, increase in deposition on terraces, soil compaction	low to high/ short term
4WD - special events	50 visitors per event 1 event/yr	Special use authorizations	Not Changed in Amendment	minor contribution to soil erosion, soil compaction	low/ short duration
rock and gem collecting	5% of visitors per year	Authorized	Not Changed in Amendment	possible destruction of plants, minor contribution to soil erosion	low/ continuous

Activity	Estimated Actual Extent of Activity within CCMA	Authorized use prior to 2006 <sup>a</sup>	Authorized use in 2006 Record of Decision on Amendment <sup>a</sup>	Type of Impacts	Intensity / Duration
Nature hiking	<5% of visitors per year	Authorized	Not Changed in Amendment	possible destruction of plants, minor contribution to soil erosion, soil compaction	low/ continuous
Hunting	5% of visitors per year	Authorized	Not Changed in Amendment	possible destruction of plants, minor contribution to soil erosion, soil compaction	low/ seasonal (August)
Grazing	5-10 trespass cattle / year	No	Not Changed in Amendment	trampling of habitat, minor contribution to soil erosion, soil compaction	low/ seasonal

a Figures based on information in Final EIS and Record of Decision for Resource Management Plan Amendment (Bureau of Land Management 2005b, 2006a)

Many miles of fence have been erected to protect habitats and riparian corridors, and a law enforcement officer is assigned to the area. Other measures have been implemented to protect sensitive habitat while maintaining OHV recreational opportunities, particularly along the Clear Creek riparian corridor. However, prohibited activities such as cutting through fences and removing signs that have been erected to protect sensitive areas still occur. These activities result in costly ongoing monitoring, repair and replacement of barriers and signs, enforcement actions, and occasional rerouting to avoid sensitive areas.

#### b. Soil Loss and Elevated Erosion Rates

Erosion on both barren and vegetated slopes causes soil loss and other physical and chemical changes. These changes negatively affect the soil texture, composition, and chemistry. They also can reduce the soil's water infiltration

capacity and productivity, which in turn affects the ability of plants to grow in these soils.

Several attempts have been made to quantify the extent of natural and human-caused soil erosion occurring within the CCMA. However, soil loss models are difficult to construct, and to extrapolate to large geographic areas. One study estimated the mean background, undisturbed soil loss in the Clear Creek watershed at 10.0 metric tons (11 tons) per acre per year (PTI Environmental Services 1993; B. Ellis *in litt.* 1994, 1996). Sediment yield to the mouth of Clear Creek from undisturbed soil conditions is estimated to be approximately 2.7 metric tons (3 tons) per acre per year. In comparison, soil loss from OHV hillclimb play areas is estimated to be approximately 14.5 metric tons (16 tons) per acre per year, with a sediment yield of approximately 4.5 metric tons (5 tons) per acres. The erosion rate from roads alone averages 72.6 metric tons (80 tons) per acre of road surface per year, and the estimated sediment yield from roads to the mouth of Clear Creek is nearly 4,536.0 metric tons (5,000 tons) per year. The CCMA plan amendment includes measures that are expected to reduce the current soil loss and sediment yield from the CCMA by reducing human-caused contributions to the total. The Bureau will implement an erosion monitoring program to determine and analyze sediment erosion and deposition affecting occupied and surrounding potential habitat within the CCMA.

Riparian habitats can be affected by accelerated sediment deposition from wet-season use of the road system in the CCMA. Sediment delivery is reduced by providing proper road maintenance. Recent changes in maintenance practices, such as the installation of water bars, are designed to further reduce sedimentation of streams.

Wet season closures are also used by the Bureau to prevent resource damage. The Bureau will temporarily close certain routes, areas, or all of the CCMA to OHV use during the wet season to reduce damage to road drainage structures and reduce delivery of sediment to streams. The Bureau implements wet season closure procedures after the annual total precipitation exceeds 20.3 cm (8 inches). Once the annual precipitation at the CCMA exceeds 20.3 cm (8 inches), any additional rainfall exceeding 1.3 cm (0.5 inch) in a 24-hour period, or 2.5 cm (1

inch) within a 72-hour period, results in a 3-day closure of the CCMA. Once part or all of the CCMA has been closed, the Bureau completes a field inspection prior to reopening in order to determine the suitability of road conditions.

The Bureau anticipates that the wet-season closures will be implemented after major rain storms and will likely occur several times per season and last between 3 to 10 days after the storm. The Bureau will post signs warning of the closures on all arterial routes leading to closed areas. Closure notices will also be included on the recorded CCMA information hotline. The Bureau has implemented wet-season closures at the CCMA in 2005 (total of 25 days) and 2006 (total of 30 days).

#### c. Facilities Construction and Maintenance

The Bureau established an Administrative Site in 1988 that lies to the north of the Clear Creek Management Area. Its purpose is to support ranger and law enforcement services and to facilitate asbestos (chrysotile) decontamination (laundry, showers and car wash/vacuum where Bureau employees decontaminate themselves and their equipment after asbestos exposure in the field). The Bureau inadvertently constructed a residence within a *Camissonia benitensis* suboccurrence (sub #19110), resulting in the direct loss of plants and habitat. Maintenance and additional minor construction activities at the Administrative Site have also resulted in inadvertent impacts to the suboccurrence. By 2003, the Bureau decided to relocate the administrative site because of health concerns about on-site asbestos exposure of Bureau staff.

#### d. Mining Activities

Mining activity in the CCMA has decreased since the early 1900s, and the last commercial mining operation ceased its activities in 2002. Residual soil erosion problems from historic mines and the access roads to them may affect certain occurrences of *Camissonia benitensis*. The 2006 CCMA plan amendment indicates that all routes through closed mine areas will be corridor-fenced by 2008. The short- and long-term effects to occupied and suitable habitat resulting from reclamation efforts required by the State of California's Division of Mines,

such as recontouring or consolidating waste materials, would depend on site-specific activities and conditions.

The primary mining activity in the CCMA now consists of rock hounding for gems and minerals. In 1994, the Bureau estimated that five percent of the visitor use was comprised of rock-hounders. We believe the impact of this activity on *Camissonia benitensis* and its habitat is minimal.

The Bureau acquired the surface, but not the mineral, rights of 208 hectares (520 acres) along the lower reaches of Clear Creek up to and including the confluence with the San Benito River. The acquisitions placed seven suboccurrences of *Camissonia benitensis* under Bureau management. Gravel mining in the area has ceased and will not occur again due to State prohibitions. While the Bureau does not own the mineral rights and therefore cannot provide absolute protection to the three suboccurrences within or adjacent to a historic mining operation, we believe that the potential for substantial mineral exploitation in this area is negligible.

#### e. Habitat Alteration due to Invasive Species

Several non-native plant species, including *Centaurea solstitialis* (yellow star-thistle) and *Taeniatherum caput-medusae* (medusahead) have recently been found in the Clear Creek watershed. Once established, these weeds are difficult to eradicate and therefore pose a potential threat to *Camissonia benitensis* habitat in certain areas. *Centaurea solstitialis* and non-native annual grasses occur on the Franciscan soils embedded as mosaics throughout the Clear Creek watershed. Several *Camissonia benitensis* suboccurrences occur at the contact zones between Franciscan and serpentine soils (Julie Ann Delgado, Bureau botanist, pers. comm. 2002). The Bureau's 2006 CCMA plan amendment includes the development and implementation of an invasive weed management program.

Feral pigs (*Sus scrofa*) are also present in the Clear Creek watershed. As pigs root for bulbs and tubers, they churn the soil. Churning not only disrupts the existing native vegetation, but also facilitates establishment of non-native plant species. Feral pig damage was extensive in spring 2002, throughout Clear Creek Canyon on partially vegetated alluvial terraces. Pigs affected several *Camissonia*

*benitensis* suboccurrences after germination had occurred. Resulting seedling mortality contributed to an overall reduction in *Camissonia benitensis* survivorship that year. Feral pig activity continued in subsequent years.

## 2. Listing Factor B: Overutilization for Commercial, Recreational, Scientific, or Educational Purposes

We did not consider overutilization for any commercial, recreational, scientific, or educational purposes a threat at the time of listing, and do not consider overutilization of *Camissonia benitensis* a threat now.

## 3. Listing Factor C: Disease or Predation

Taylor (1990) documented 80 percent seedling mortality in 6 populations in 1988. Most of the seedlings disappeared without evidence of the cause of mortality. Approximately one third of the small number of plants with ascertainable mortality had evidence of insect predation. However, predation did not warrant inclusion in this plan as a significant issue. No pathogens have been observed on *Camissonia benitensis*.

## 4. Listing Factor D: The Inadequacy of Existing Regulatory Mechanisms

At the time of listing, *Camissonia benitensis* received minimal protection from existing Federal, State, and local laws, regulations, and ordinances. A discussion of subsequent regulatory mechanisms and their applicability to the conservation of the species is found below in section I.H (Conservation Measures).

As of 2001, the California Department of Parks and Recreation requires a Wildlife Habitat Protection Plan (WHPP) to be part of any grant application submitted to the Green Sticker fund.<sup>2</sup> The WHPP is required to comply with the provisions of

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<sup>2</sup> The Off-Highway Motor Vehicle Recreation Division of the CDPR manages funds that support efforts to mitigate and restore lands impacted by OHV recreation; this program is commonly called the "Green Sticker" fund.

the California Environmental Quality Act and the California Endangered Species Act to guarantee that recipients do not jeopardize the continued existence of state-listed species with projects using State of California funds. The WHPP summarizes the protection and management of all Federal and State endangered, threatened, and special status plant and animal species that occur within the project area. The first WHPP for the CCMA was developed in 2003; updates are now made annually (U.S. Bureau of Land Management 2006a).

In 1997, the Bureau initiated a compliance monitoring program to track user compliance with regulations governing resource protection and recreational use of the CCMA. The program set forth three criteria that would trigger closure of the CCMA: (1) reaching a threshold of 15 violations; (2) insufficient funds or personnel to carry out monitoring; and (3) failure to monitor. The monitoring program has been useful in providing feedback to the Bureau on its management of the area, and has assisted in identifying chronic management problems. The Bureau and the Service are currently working to refine the monitoring program; other recent changes in CCMA management and monitoring are discussed in section I.H (Conservation Measures).

## 5. Listing Factor E: Other Natural or Manmade Factors Affecting its Continued Existence

### a. Succession to Woody Shrub Community

Woody plants have been encroaching on a number of alluvial terraces and may be reducing the amount of habitat available for *Camissonia benitensis* (Taylor 1990).

This observation may be confirmed by the more precisely established photo-points started in 1996 (U.S. Bureau of Land Management 1997a). Taylor (1990) speculated that seed of *Camissonia benitensis* is not likely to remain viable through an entire cycle of woody encroachment into occupied habitat. Whether woody encroachment and resultant shading would eliminate this species from an area depends on how long the seedbank remains viable and the interval for a stand-replacing fire to occur. While at least three fires have occurred within the CCMA since the 1950s, none has gone through occupied or potential habitat.

Prescribed fire could potentially be employed to reverse encroachment of woody vegetation into terrace sites. However, prescribed burning appears impracticable because of the potential health hazard associated with the asbestos-bearing soils in the San Benito serpentine area. The asbestos hazard prevents participation in fires by the California Department of Forestry and Fire Protection and the Department of Corrections, which cooperate with the Bureau to implement prescribed fire.

#### b. Stochastic Events

Randomly-occurring events, such as prolonged drought, wildfire, flooding, and catastrophic erosion and sedimentation, have the potential to affect the continued existence of this species, but to an unknown extent. While these natural catastrophic events are difficult or impractical to manage at the time they occur, improved resource management to address human caused impacts over a long period of time can reduce the severity of their effects on the species. The probability of extinction for *Camissonia benitensis* from random events can be reduced in the following ways:

- 1) By allowing for the persistence of widely dispersed occurrences and potential habitat, so that species survival does not depend on a few occurrences. By fencing entire habitat polygons with moderate to high potential habitat, the Bureau is increasing the opportunity for *Camissonia benitensis* to be widely dispersed throughout its potential habitat.
- 2) By maintaining healthy watersheds with intact edaphic (soil function) and hydrologic regimes. While the natural rate of erosion may result in the disappearance of terrace habitat, the formation of new terraces would balance losses over time. The Bureau can reduce erosion and sedimentation by providing better road drainage on designated routes for OHV travel and by closing and restoring illegal or closed routes. Out of 33 routinely monitored *Camissonia benitensis* suboccurrences in the Clear Creek and upper San Benito River watersheds, none experienced substantial loss of habitat from either erosion or sedimentation during very high rainfall during the winter of 1997/1998. Two suboccurrences had

minor adjacent bank erosion (sub #11100 and #291100); two had minor and localized sediment deposition (sub #21400 and #291300); three had minor but visible evidence of surface sheet flow (sub #111100, #131100, and #271100); and one had significant sediment deposition on an unoccupied portion of its potential habitat polygon (sub #121100) (S. Fitton, pers. comm. 1998). The major runoff events of 1995, appeared to have extirpated two suboccurrences (sub #181100 and #291300). However, suboccurrence #291300 reappeared and expanded in 1998. These two suboccurrences are unusual because they are on floodplains rather than on higher and less-frequently disturbed terraces. Although floodplain sites may be more ephemeral than terrace sites, the ability of *Camissonia benitensis* to reestablish there naturally, as was documented in 1998, demonstrates their importance to the species.

The threat from randomly-occurring natural events is now considered less than was thought at the time of listing, because the species is now known from 27 occurrences and 53 suboccurrences compared to 9 occurrences at the time of listing. Also, the species' distribution is now known to extend downstream along the San Benito River and into additional watersheds (Lorenzo Vasquez Creek, Laguna Creek, White Creek, upper reaches of Clear Creek, Larious Creek, Picacho Meadow, San Benito River, and an unnamed tributary to the San Benito River downstream of the confluence with Lorenzo Vasquez).

## ***I. CONSERVATION MEASURES***

### **1. Available Laws, Regulations, and Ordinances**

#### **a. Federal**

*Camissonia benitensis* was listed as a threatened species on February 12, 1985. Section 4 of the Endangered Species Act of 1973 (Act), as amended, requires us to develop a recovery plan that describes site-specific management actions necessary for the conservation and survival of listed species. The plan must have objective, measurable criteria, which when met will allow *Camissonia benitensis*

to be removed from the Federal list. The plan must estimate the time needed and the cost to carry out the conservation measures. After *Camissonia benitensis* is removed from the list, we must, in cooperation with the State of California, effectively monitor for not less than five years the plant's status and we must be prepared to restore *Camissonia benitensis* to the list, if necessary.

Other provisions of the Act may also apply:

- Section 5 of the Act authorizes the Department of the Interior to acquire habitat essential to preserving listed species.
- Section 6 directs us to cooperate with states to maintain adequate programs for the conservation of listed species.
- Section 7 of the Act requires Federal agencies to use their authorities to carry out programs for the conservation of listed species and to consult with us whenever they may affect listed species through their actions. Our consultation with the Bureau on the Clear Creek Management Plan is further discussed in the following section on Conservation Measures Undertaken.
- Section 9 of the Act provides for protection of listed species. On Federal lands or lands under Federal jurisdiction, it is a violation to remove or reduce to possession threatened or endangered plants, or to maliciously damage or destroy them. On other lands, listed plants may not be removed, cut, dug up, or damaged in knowing violation of any state law or regulation. Listed plants also cannot be sold, shipped, or received in interstate or foreign commerce.
- Section 10 permits exceptions to the protections granted under section 9 in the form of recovery and incidental take permits.

The Bureau has regulations and policies that guide the management of natural resources on the public lands they manage. In particular, the U.S Congress passed the Federal Land Policy and Management Act of 1976 to provide policy for the management, protection, development, and enhancement of public lands managed by the Bureau. This law directs the Bureau to, by regulation or otherwise, “take any action necessary to prevent unnecessary or undue degradation of the lands” during mining operations (43 U.S.C. 1732 (b)). Mining operations that exceed 5 acres, and certain other defined operations, require a plan

of operations approved by the Bureau (43 CFR 3809.1-4, 1-6). However, before approving the plan, the Bureau must comply with section 7(a)(2) of the Act for any species that: a) is proposed or listed as endangered or threatened, or b) has proposed or designated critical habitat.

The Code of Federal Regulations found in Title 43, Volume 2, Part 8340 and 8364, gives the Bureau the ability to enact special rules to protect soil, vegetation, wildlife, threatened or endangered species, wilderness suitability, and other resources by immediately closing affected areas to off-road vehicles that are causing resource damage until the adverse effects are eliminated and measures are implemented to prevent recurrence.

Two Executive Orders (EO) apply specifically to off-road vehicles on public lands:

- EO 11644 directs agencies to designate zones of off-road use that are based on protecting natural resources, the safety of all users, and minimizing conflicts among various land uses. The Bureau and other agencies are to locate such areas and trails to minimize damage to soil, watershed, vegetation, or other resources, and to minimize disruption to wildlife and their habitats. Areas may be located in designated park and refuge areas or natural areas only if the head of the agency determines that off-road use will not adversely affect the natural, aesthetic, or scenic values of the locations. The respective agencies are to ensure adequate opportunity for public participation in the designation of areas and trails.
- EO 11989 amends the previous order by adding the following stipulations: a) whenever the agency determines that the use of off-road vehicles will cause or is causing considerable adverse effects on the soil, vegetation, wildlife, wildlife habitat, or cultural or historic resources of particular areas or trails on public lands, it is to immediately close the areas or trails to the type of off-road vehicle causing the effects until it determines that the adverse effects have ceased and that measures are in place to prevent future recurrence; and

b) each agency is to close portions of public lands within its jurisdiction to off-road vehicles except areas or trails designated as suitable and open to off-road vehicle use.

In 2001, the Bureau published the National Management Strategy for Motorized Off-Highway Vehicle Use on Public Lands. The purpose of this guiding document is to ensure consistent and positive management of environmentally responsible motorized OHV use on public lands.

#### b. State

At the state level, the California Environmental Quality Act provides some protection for threatened and endangered species on private lands through the environmental review process. Initially, the lead public agency reviews a project to determine whether the project would create negative impacts to State or federally listed species. If the lead agency does not consider the impacts significant, a formal environmental impact report is not required, and the project is granted a negative declaration with measures or recommendations to reduce environmental impacts. If the lead agency finds that the project's impacts are significant, the project applicant must prepare an environmental impact report, consisting of a description of existing site conditions, impact analysis, and detailed mitigation measures to reduce project impacts to a less-than-significant level. Mitigation measures, such as avoidance, fencing, or landowner education programs must be incorporated into the approved projects, and should provide long-term protection of the species. However, if no mitigation measures are feasible and if the lead agency determines that benefits of the project outweigh the environmental risks, the lead agency may approve a project that has significant environmental effects by making a statement of overriding considerations. Certain activities, such as agricultural operations, timber harvesting, and mining assessment, are exempt under the California Environmental Quality Act. Some private lands are interspersed with Bureau of Land Management lands, particularly in the White Creek watershed. Although no projects are currently proposed on these private lands, changes in economic factors or technology may prompt development, especially for mining operations. Companies may propose projects in the future, or *Camissonia benitensis* may be found on other private lands.

The State of California requires mining plans of operation to include reclamation activities for all mine sites over 1 acre or over 1,000 cubic yards in volume. Reclamation is intended to prevent or minimize the negative impacts of surface mining to public health, property, and the environment (State Mining and Reclamation Act) (California Division of Mines and Geology 1975). This requirement applies to mines on Federal, State, and private lands. Local lead agencies administer reclamation. The County of San Benito is the lead agency for mining operations in the Clear Creek Management Area.

In cooperation with the U.S. Forest Service and the California Department of Parks and Recreation's (CDPR) Off-Highway Motor Vehicle Recreation Division, the Bureau assisted in developing and publishing guidelines for soil conservation for OHV recreation management (California Department of Parks and Recreation 2002). Part II of this recovery plan incorporates many of the standards documented in the guidelines. The State Public Resources Code requires that the guidelines be applied to OHV recreation areas managed or funded by the State. The guidelines document the significance of soil resource losses due to OHV recreation, and establish standards for restoration efforts.

The State Water Resources Control Board (SWRCB) is the designated state agency that implements the Federal Water Pollution Control Act (33 U.S.C. 1251, et seq.). As of January 1, 2004, the Bureau is obligated to monitor water quality in areas that exceed total maximum daily loads (TMDL) of certain pollutants, as per section 303 (d) of the Federal Water Pollution Control Act. The SWRCB is responsible for determining, in the case of excessive TMDLs, if land use restrictions may be necessary for the protection of public health, safety, or the environment.

*Camissonia benitensis* is a California Native Plant Society List 1B species. This classification indicates that the species qualifies for listing as threatened or endangered by the California Department of Fish and Game. Under the California Environmental Quality Act, the lead agency responsible for compliance with state environmental laws needs to fully consider the species

during preparation of environmental documents for proposed projects on private lands.

## 2. Conservation Measures Undertaken

### a. Federal

The Bureau has long recognized the uniqueness and importance of the Clear Creek Management Area (see Appendix C), by implementing the following conservation measures:

- Designation of the San Benito Mountain Natural Area in 1968, in recognition of the unique serpentine forests and associated plant communities;
- Erection of pipe barriers and fences starting in the 1970s, to protect the known populations of *Camissonia benitensis*;
- Implementation of a plan in 1982 for off-road vehicle designation in the Clear Creek Recreation Area (as it was once called). This initial plan included 16,000 acres of limited use, approximately 2,000 acres closed to use, and 25,000 acres designated as open to use; and
- Monitoring of *Camissonia benitensis* populations beginning in 1983.

The Bureau issued the Hollister Resource Management Plan in 1984, which included general direction to protect and manage habitat for *Camissonia benitensis* and other sensitive species. In 1986, the Bureau developed the Clear Creek Management Plan and Decision Record to address on-the-ground management needs and actions for the CCMA. The 1986 Clear Creek Management Plan included a major goal of reducing the high concentration of visitor use in the Clear Creek Canyon where conflicts have resulted from over-use of the relatively small area. The 1986 Plan also documented issues pertaining to endangered plant habitat, water quality, and erosion along the Clear Creek stream corridor. The stated goals for sensitive species habitat included:

- Determining minimum population sizes necessary to sustain plant taxa;
- Managing habitat to protect these taxa; and
- Managing the unique plant community in the San Benito Mountain Natural Area.

Other management goals included:

- Developing recreational facilities;
- Providing more management of recreational activities;
- Improving watershed management by stabilizing and restoring areas degraded by OHVs;
- Constructing silt catchments in Clear Creek Canyon; and
- Maintaining major roads and trails according to a work schedule.

In 1983, we proposed listing *Camissonia benitensis* as a federally endangered species. In listing *Camissonia benitensis* as threatened rather than endangered in 1985, we acknowledged the actions that the Bureau planned to implement according to the draft CCMA Management Plan, as well as steps that the Bureau took at that time to manage the species appropriately, including: building recreation staging areas with outhouses to encourage concentrated (rather than dispersed) camping, and constructing low water crossings along Clear Creek to reduce sediment delivery.

Following the recommendations of our unpublished first draft of the recovery plan for *Camissonia benitensis* (U.S. Fish and Wildlife Service 1988), the Bureau funded an extensive life history study, which was carried out by Dean Taylor. The study focused on seven tasks: 1) monitoring the demography of plant occurrences, 2) population census, 3) germination and growth requirements, 4) breeding system and pollination, 5) animal interactions, 6) competitive interactions, and 7) habitat requirements. The data from this study have enhanced the knowledge of the species and helped shape this recovery plan.

In 1993, we coordinated with the Bureau during its preparation of an amendment to the 1984 Hollister Resource Management Plan (RMP), titled the Clear Creek Management Area Resource Management Plan and Draft Environmental Impact Statement. Because we had initiated preparation of the draft recovery plan for *Camissonia benitensis*, we discussed with the Bureau the potential effects of the preferred alternative on recovery goals for the species (U.S. Fish and Wildlife Service 1995, 1997). The Bureau published the final environmental impact statement (EIS) and plan in 1995, and the associated Record of Decision was signed in 1999 (Bureau of Land Management 1995, 1999b).

In 2006, the Bureau approved an amendment to the CCMA RMP. The Record of Decision (Bureau of Land Management 2006a) adopted criteria for determining whether routes and barrens should be open or closed to OHV use, and specifically designated where OHV use is permitted within the CCMA, including 389 kilometers (242 miles) of routes and 193 hectares (478 acres) of barrens. All routes and barrens not designated as open or limited use are closed to OHV use. Implementation of route closures is to be accomplished by placing signs at designated open or limited-access routes; closed routes may be signed on a priority basis if compliance problems occur. Closed routes providing access to *Camissonia benitensis* habitat are to be signed, fenced, and barricaded. *Camissonia benitensis* exclosures are to be enlarged to the boundaries of the habitat polygon. The boundaries of the San Benito Mountain Research Natural Area were also expanded

#### The CCMA Plan and *Camissonia benitensis*

The Bureau's 1999 Record of Decision selected a proposed action from the Clear Creek Final Environmental Impact Statement for the Clear Creek Area Management Plan using information acquired from studies on asbestos-related health risks, rare plant research, and an analysis of erosion problems. The five objectives of the CCMA Plan are:

1. Reduce asbestos exposure and emissions while providing opportunities for OHV use. Minimize dust emissions from main roads. Ensure that Bureau staff meet all Occupational Safety and Health Administration requirements.
2. Protect existing populations of *Camissonia benitensis* and attempt to expand its range into areas that have moderate and high potential habitat for the species. Manage to ensure that sensitive species and communities maintain or enhance their condition
3. Maintain or enhance water quality in all watersheds. Reduce erosion and sediment transport in all CCMA watersheds by reducing the number of miles and barren acreage available for vehicle use, and by implementing BMP's for all road work.
4. Expand the boundaries of the San Benito Mountain Natural Area to include a contiguous cross-section of the serpentine and adjacent ecotones found only within this area area, using easily identifiable geographic landmarks as boundaries wherever possible.
5. Manage the CCMA as a Limited Use area. Based upon resource management criteria, designate routes and open play areas available for OHV use as resource conditions warrant.

from its original 760.8 hectares (1880 acres) to 1678.2 hectares (4,147 acres), and an interim management plan for the SBMRNA was adopted. These amendments to the management plan were designed to contribute to the reduction of threats from OHV use and erosion.

#### b. State

The Off-Highway Motor Vehicle Recreation Division of the California Department of Parks and Recreation (CDPR) manages funds that support OHV recreation and efforts to mitigate and restore lands impacted by it. This program is commonly called the Green Sticker fund. The State of California collects funds from licensing OHVs. The CDPR distributes the funds, through an annual grants program, to designated OHV recreation sites throughout the State. The grants program requires that recipient recreation sites be managed according to certain criteria. The CDPR revised these criteria in 2001 and 2003, to include more stringent standards for reducing soil loss and for managing wildlife and sensitive species sustainably (California Department of Parks and Recreation 2002).

Since 1995, the Bureau has taken advantage of this program annually to support management of the CCMA. From 1995 through 2001, the average grant amount received was approximately \$150,000. CDPR stipulates that a portion of these funds be applied to protecting *Camissonia benitensis* through fencing, signing, and public education efforts. Funding has also been used to purchase materials and equipment, to fund maintenance work on roads and trails, and on law enforcement.

#### c. Other

The Sierra Club and the California Native Plant Society have furnished volunteers to assist Bureau staff with OHV compliance monitoring, rare plant monitoring, installing protective fences, and rare plant and vegetation inventory. Off highway vehicle groups have furnished volunteers to install protective fencing and assist in information outreach efforts.

### 3. Potential Measures to Avoid and Minimize Impacts

If the Bureau or a project applicant proposes projects that will adversely affect *Camissonia benitensis* or its habitat, the Bureau should make every effort to avoid direct impacts. If avoidance is not possible, minimization measures should be developed to reduce impacts to the maximum extent practicable. *Camissonia benitensis* habitat enhancement measures should also be developed as mitigation measures, and the Bureau should incorporate conditions into the project plan.

Our policy regarding controlled propagation of listed species states that controlled propagation is not a substitute for addressing factors responsible for an endangered or threatened species' decline (U.S. Fish and Wildlife Service 2000). Certain restoration efforts using propagated individuals may be appropriate--for instance, removal and restoration of roadbeds that bisect *Camissonia benitensis* populations, or restoration of habitat that has been affected by mining activities. However, transplanting seed or individuals has generally been unsuccessful for establishing self-sustaining populations (Fiedler 1991).

We suggest the following measures for avoidance and minimization measures:

- If *Camissonia benitensis* is thought to occur on a potential project site, confirmation from a qualified botanist or biologist should be obtained early in the project planning process.
- If the proposed project would directly remove part or all of a known *Camissonia benitensis* occurrence or suboccurrence, the project should be redesigned to avoid direct impacts to the extent possible.
- If the proposed project would have secondary impacts because it alters ecologic processes (hydrology, edaphic conditions) on part or all of a site supporting an occurrence or suboccurrence, the project should be reconfigured to avoid secondary impacts to the extent possible.
- If the proposed project would have secondary impacts in the form of increasing traffic (motorized and non-motorized) from humans, horses, or

pets, then fencing, barriers, then signing should be used to reduce their impacts.

- If the proposed project would include use of tackifiers (dust suppressors), and affect habitat either through runoff or overspray, the project should be reconfigured to avoid these impacts to the extent possible.
- If the proposed project would have secondary impacts from groundwork that could increase encroachment of non-native plants into *Camissonia benitensis* habitat, minimization measures should be taken, such as removing existing weed seed sources, using only appropriate local native species in seed mixes, and including weed control measures in restoration efforts.

## II. RECOVERY STRATEGY

The main purpose of this recovery plan is to outline recovery actions that will prevent further loss of *Camissonia benitensis* within the Clear Creek Management Area and the surrounding geographic area, and that will allow for its recovery.

*Camissonia benitensis* is an annual plant whose population fluctuates dramatically in response to environmental conditions, and establishes a persistent soil seed bank to maintain a reservoir of seeds from year to year. It is endemic to a limited habitat of alluvial terraces and debris flows within serpentine soils. Consequently, the species is vulnerable to impairment of the seed bank and loss of the substrate for suitable habitat through soil erosion. Currently a significant contributor to erosion is OHV use, which can also destroy or damage plants directly by crushing them; mining and grazing activities can also accelerate erosion.

Recovery efforts for *Camissonia benitensis* should maintain the ecological integrity of the watersheds where it occurs so that habitat is not being eroded at a faster rate than suitable alluvial terraces and floodplains can be replaced and recolonized through natural processes. *Camissonia benitensis* requires habitat that is occupied, available for future occupation, and able to facilitate dispersal among sites. Restoring the ecological integrity of watersheds requires reducing impacts from motorized recreation, mining, grazing, and other activities that increase rates of soil erosion above natural levels. Measures to reduce these impacts include installation and maintenance of fences and barriers around sites occupied by *Camissonia benitensis*, closure of areas and trails to OHVs, and signage and enforcement to implement these closures. In addition to reducing impacts from ongoing human activities, certain sites may require efforts to restore habitat that has already been damaged severely or has erosion rates substantially greater than the range and frequency of historical variation. Erosion control measures and watershed management plans should be established to restore these habitats. Even with implementation of appropriate management and protection, watershed recovery will take time and we believe that recovery of *Camissonia benitensis* may take decades.

Because *Camissonia benitensis* is vulnerable to successional encroachment by chaparral and invasive exotic plants, management to maintain suitable open habitat and control weeds may also be advisable in order to maintain existing populations or enhance habitat for purposes of population introduction. The feasibility and effects of localized prescribed fire upon populations and habitat should be studied.

Because *Camissonia benitensis* has a limited distribution, occurrences, suitable habitat, and the watersheds within which they occur should be appropriately managed and protected. To maintain the genetic variability in the species that may be harbored by outlying occurrences, it is important to protect occurrences and suitable habitat throughout the range of the species. Because the Bureau has responsibility for most *Camissonia benitensis* habitat, it is critical for its lands to be managed for this species through effective OHV closures and public outreach to enlist the cooperation of OHV groups and other visitors in protecting sensitive areas. Additional habitat occurs on adjacent private lands, and coordination with private landowners to protect and enhance habitat should be established.

To continually assess the effectiveness of management actions, an ongoing monitoring program should continue to track trends in *Camissonia benitensis* populations, changes in habitat quality and extent, erosion impacts, and user compliance with OHV closures. Monitoring data should be used to inform future decisions about management of the CCMA.

Even with appropriate management and protection, *Camissonia benitensis* remains vulnerable because the species appears ephemerally and because its habitat is fragile, limited, and subject to rapid alteration. We do not know enough about population dynamics of *Camissonia benitensis* to predict how many and what size populations (including the seedbank) are sufficient to ensure that the species will not become extinct. Research needs to focus on seedbank ecology and the role that the seedbank plays in the long-term persistence of the species. We do not know how quickly the species naturally colonizes newly-formed habitat or how quickly topography and hydrologic processes interact to cause habitat loss and replacement. Habitat and population modeling would likely further the understanding of the relationship between population dynamics and

turnover in habitat availability. Research to improve introduction methods may also contribute to establishment of new populations; an *ex situ* seed collection representing a variety of occurrences should be established as a source for future introduction efforts.

### III. RECOVERY

#### A. RECOVERY GOAL

The ultimate goal of this plan is to recover *Camissonia benitensis* to the point where delisting is appropriate. The species will be eligible for delisting consideration when populations are self-sustaining, secure, and meet the criteria outlined below as modified after research results are available. Management actions and research are needed to protect, conserve, and recover *Camissonia benitensis*. The plan provides preliminary criteria for recovery and delisting, and outlines the actions needed to accomplish each criterion.

Delisting criteria for listed species typically consist of: 1) minimum numbers of individuals and populations, 2) ability of the species to be self-sustaining and survive over some time period, 3) abundance and distribution of habitat, and 4) the removal or management of actual and potential threats. The recovery criteria presented in the draft recovery plan combined the projections from the life history reports of Taylor (1995), comments from the Bureau, and information in our files at that time (U.S. Fish and Wildlife Service 1997). The criteria relied on establishing and maintaining certain numbers of individuals, populations, and occurrences of *Camissonia benitensis* over time.

However, in the intervening years, several factors have caused us to reevaluate those criteria: 1) additional occurrences have been located, 2) 7 additional years of population monitoring have been analyzed, and 3) 7 years of compliance monitoring have been analyzed. The new information from population monitoring indicates that the overall number of individuals continues to be small. Because only 2 years (1988 and 2005) in over 20 years of monitoring have resulted in exceptionally large populations, this species may have a good year less frequently than previously believed. If good years seldom occur, focusing on specific target numbers of individuals may not be the most useful indicator of species stability.

Because the long-term persistence of *Camissonia benitensis* requires available suitable habitat, we now believe it is more appropriate to base recovery criteria primarily on factors relating to the abundance and quality of habitat, using population numbers as an index to long-term trends rather than as specific numeric targets. In addition, the effectiveness of protective measures that reduce the threats from human activities, in particular from recreational activities, should be addressed.

## **B. RECOVERY OBJECTIVES**

The immediate objective of this recovery plan is to prevent further net loss of *Camissonia benitensis*, and to prevent the further deterioration of its habitat. The short-term objective is to eliminate or reduce current threats to *Camissonia benitensis* and the need to upgrade the species to “Endangered.” The long-term objective is to delist the species.

## **C. RECOVERY CRITERIA**

The delisting criteria below are considered preliminary, and additional research should be conducted to adequately assess the potential for habitat restoration and to model the long-term persistence of populations. Population modeling would need to consider parameters such as fluctuating environmental conditions, impacts of erosion and OHVs, persistence of the soil seedbank, and annual variation in population size. Delisting criteria should be reevaluated, as appropriate, based on the results of this research. *Camissonia benitensis* can be considered for delisting when:

- 1. Research has been completed and delisting criteria 2 – 4 have been refined as appropriate based on research findings.**  
Factors that should be studied include:
  - a) Potential for restoration of serpentine terrace habitat and natural rate of habitat replacement (excluding human-caused activities);
  - b) Ecology of *Camissonia benitensis* seedbanks; and

c) Population viability modeling and estimation of habitat area and population levels necessary for dispersal, seedbank viability, and long-term persistence of the species.

**2. Known occurrences and sufficient additional suitable habitat within each watershed unit throughout its range are protected from direct effects from OHV use and other recreational activities. Appropriate levels of compliance with use regulations by recreationists have prevented adverse impacts to *Camissonia benitensis* suboccurrences and habitat.**

Specific occurrences should be protected as needed, and OHV use should be restricted to designated trails and open play areas. Protective agreements should be established with private landowners.

We have clustered occurrences into geographic units within watersheds and subwatersheds (see Figure 2 and Table 8). The core area for the species consists of habitat within Clear Creek Canyon. This watershed is central to the recovery of the species, because it contains 70 percent of the occurrences managed by the Bureau and about 75 percent of the total number of individuals of *Camissonia benitensis*.

To be determined based on further research:

- a) A better understanding of the number and location of all existing occurrences and seed banks from year to year;
- b) Sufficient amount of additional suitable habitat to allow dispersal and ensure healthy ecosystem functions.

**3. Currently occupied and suitable habitat for the species has been restored and maintained over an appropriate period of time, as informed by monitoring and research.**

Given current knowledge, we expect that the “appropriate period of time” will be no less than 20 years. Because the number of individuals in a suboccurrence fluctuates widely from year to year, more emphasis should be placed on maintaining the habitat that supports known suboccurrences.

Optimal habitat should be defined more precisely based on further research; disturbance and erosion rates should not be elevated above natural levels in key areas, and seed banks supporting viable populations of *Camissonia benitensis* must persist in suitable habitat.

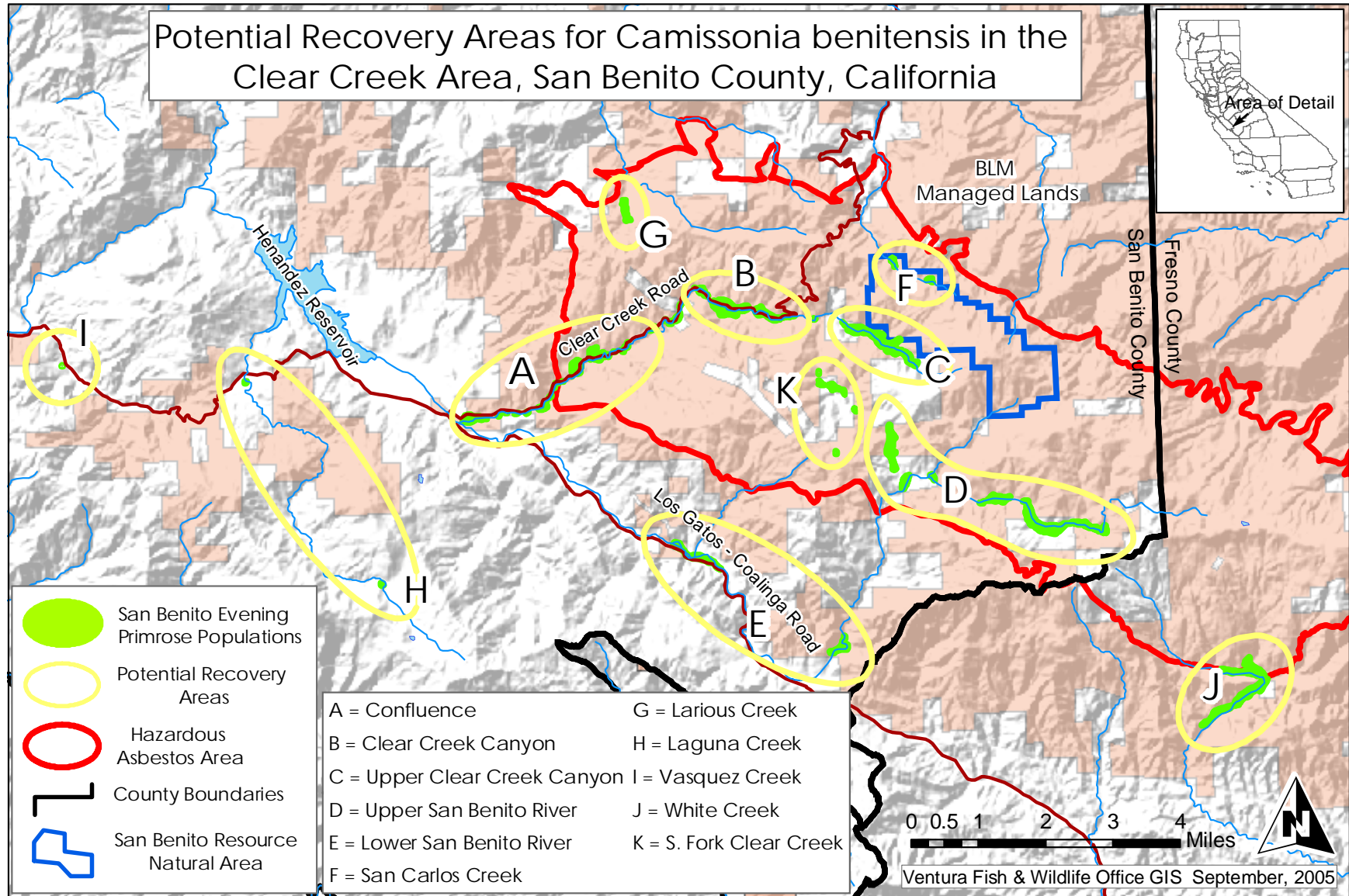
**4. Population sizes have been maintained over a monitoring period that includes multiple rainfall cycles (successive periods of drought and wet years).**

The trend in overall population size during non-drought years (greater than 15 inches precipitation from October-April at the Priest Valley station) should be stable or increasing. Population levels may be best assessed under logarithmic transformation due to the degree of natural variability. Table 8 indicates rough target numbers of individuals for each watershed unit based upon the past performance of suboccurrences in favorable years; these targets should be used as a point of reference for gauging success but may be approximate due to the natural variability in population numbers between years. A 20-year monitoring period is likely to include a variety of climatic conditions representative of the long-term range of environmental variability.

For suboccurrences that have larger populations (e.g., frequently over 500 individuals or 2 acres), monitoring based on density or frequency may be more appropriate than total population counts. Currently, density monitoring would be appropriate to use for populations at the following sites:

- Mouth of Clear Creek (sub # 11100);
- Staging Area 1 parking lot (sub # 21400);
- Staging Area 2 pipe barrier (sub # 31100);
- Slot (sub #41100);
- West of Indian Hill (subs #51100 and 51200);
- San Carlos Meadow (sub # 91100);
- Clear Creek/San Benito Wash (sub # 111100);
- Upper Clear Creek at McCullough (sub # 121100); and
- Clear Creek/San Benito Wash (sub # 291100).

**5. A post-delisting monitoring plan for the species has been developed.**



**Figure 3.** Potential recovery areas for *Camissonia benitensis* in the Clear Creek area.

**Table 8.** Recovery goals for geographic units with *Camissonia benitensis*.

Watershed Unit/ Geographic Unit	Population/Occurrence (# of Suboccurrences)	Achieve Conservation Through <sup>3</sup>	Occupied and Suitable Habitat to be Maintained	Target Number of Individuals to be Maintained <sup>4</sup>
<b>Watershed Unit: CLEAR CREEK</b>				
A. Clear Creek/ San Benito River Confluence and Lower Clear Creek Canyon	Wash /290000 (5) and 111000 (1)	MP	< 5 acres	1,000
	Fence crossing/11100 (1)	MP	< 5 acres	100
	High Terrace/141000 (1)	MP	< 5 acres	100
	Staging Area 1/ 21000 (5)	MP	< 5 acres	100
	Jade Mill /251000 (1)	MP	< 5 acres	100
	Staging Area 2/ 31100 (1)	MP	< 5 acres	1,000
	Culvert Camp/281000 (1)	MP	< 5 acres	100
<b>Total</b>	<b>16 suboccurrences.</b>			<b>2,500</b>
B. Middle Clear Creek Canyon	Slot /41000 (4)	MP	< 5 acres	500
	Indian Hill/51000 (5)	MP	5 to 50 acres	10,000
	Staging Area 5/ 81000 (2)	MP	< 5 acres	100
<b>Total</b>	<b>11 suboccurrences.</b>			<b>10,000+</b>
C. Upper Clear Creek Canyon	McCullough/ 121100 (1)	MP / CA	5 to 50 acres	1,000
	First Approach/ 122100 (1)	MP / CA	5 to 50 acres	2,000
<b>Total</b>	<b>2 suboccurrences.</b>			<b>3,000</b>
D. South Fork Clear Creek	Picacho Meadow/ 270000 (1)	MP	< 5 acres	100

<sup>3</sup> MP: Approved and implemented management plan with monitoring; CA: Conservation agreement with landowners.

<sup>4</sup> Approximate population level expected under favorable environmental conditions, to be used as a general point of reference for gauging success. Numbers are based on averages of good years.

Watershed Unit/ Geographic Unit	Population/Occurrence (# of Suboccurrences)	Achieve Conservation Through <sup>3</sup>	Occupied and Suitable Habitat to be Maintained	Target Number of Individuals to be Maintained <sup>4</sup>
Total	1 suboccurrence.			100
Watershed Unit: SAN BENITO RIVER				
E. Upper San Benito River	San Benito Mill /131000 (1)	MP	< 5 acres	100
	Sawmill Creek /181000 (1)	MP	< 5 acres	500
	Upper San Benito River/ 101000 (1)	MP	< 5 acres	100
	Upper San Benito River/ 260000 (1)	MP	< 5 acres	1,000
Total	4 suboccurrences.			1,700
F. Lower San Benito River	Lower San Benito River/ (71000) (4)	CA	5 to 10 acres	1,000
	Lower San Benito River/ (161000) (2)	CA	5 to 10 acres	200
Total	6 existing suboccurrences.			1,200
Watershed Unit: SAN CARLOS TRIBUTARY TO SILVER CREEK				
G. San Carlos Creek	San Carlos Meadow/ 91100 (1)	MP	< 5 acres	5,000
	San Carlos chaparral/ 91200 (1)	MP	< 5 acres	300
Total	2 suboccurrences.			5,300
Watershed Unit: LARIOUS TRIBUTARY TO SILVER CREEK				
H. Larios	Confluence /61100 (1)	MP	< 5 acres	1,000
	LADI rock /61200 (1)	MP	< 5 acres	100
Total	2 suboccurrences.			1,100

Watershed Unit/ Geographic Unit	Population/Occurrence (# of Suboccurrences)	Achieve Conservation Through <sup>3</sup>	Occupied and Suitable Habitat to be Maintained	Target Number of Individuals to be Maintained <sup>4</sup>
Watershed Unit: LAGUNA CREEK				
I. Laguna Creek	Private /221100 (2) 241100	CA	< 5 acres	100
Total	2 suboccurrences.			100
Watershed Unit: LORENZO-VASQUEZ CREEK				
J. Lorenzo - Vasquez Creek	Private /151100 (1)	CA	< 5 acres	100
	Admin Site /191100 (1)	MP	< 5 acres	200
Total	2 suboccurrences.			300
Watershed unit: WHITE CREEK				
K. White Creek	Bureau and private 201000 (5)	MP / CA	5 to 50 acres	2,000
Total	5 suboccurrences.			2,000

### Reclassification

In light of the management challenges that face the Bureau, there is the possibility that the species may be reclassified as endangered in the future. *Camissonia benitensis* should be considered for reclassification as endangered under the Endangered Species Act if:

**1. Habitat condition within currently occupied or suitable habitat shows a substantial decline.** Habitat condition should be assessed with respect to baseline condition in 2006, based on monitoring of erosion and OHV damage, feral pig impacts, invasive plants, and succession to woody vegetation.

or

**2. Population sizes decline over a 20-year period that includes multiple rainfall cycles (successive periods of drought and wet years).** This criterion is met if the overall log-transformed population size during non-drought years (greater than 15 inches precipitation from October-April at Priest Valley) declines significantly over a monitoring period of 20 years or longer.

or

**3. The Bureau is unable to effect sufficient compliance with OHV restrictions in *Camissonia benitensis* habitat within the Clear Creek Management Area as the amended CCMA Management Plan is implemented.** The OHV restrictions, trail signage, and enforcement identified in the management plan are scheduled to be phased in over 5 years (U.S. Bureau of Land Management 2006a, Appendix C). As noted in the listing rule (U.S. Fish and Wildlife Service 1985), initiation of protective measures by the Bureau supported the original listing as threatened (vs. endangered), but the uncertainty of protection renders the species particularly vulnerable. Because OHV damage continues to occur, compliance with measures included in the amended management plan will be key to improvement of habitat conditions.

## IV. RECOVERY ACTION NARRATIVE

The section 7 consultation process of the Federal Endangered Species Act is an essential mechanism for minimizing or eliminating adverse impacts to *Camissonia benitensis* from recreation and other Federal actions and for ensuring that the recovery of the species remains possible. Because section 7 consultations are an ongoing obligation of the Bureau and other Federal agencies, they are not included as an action in this recovery plan.

The following actions are provided as guidance, and outline what activities we believe will contribute to recovery of the species. We also acknowledge that a number of these actions are currently being implemented, and we believe they should continue to occur in the future, as appropriate.

### **1. Protect known occurrences and suitable habitat for *Camissonia benitensis* throughout its range in the CCMA.**

Nearly all occurrences of *Camissonia benitensis*, along with certain species of concern, in the Bureau's CCMA (see Tables 1 and 2) have been exposed to human activities that threatened their persistence. Reduction of the threats to the Clear Creek ecosystem is necessary to recover the species and its habitat. The Bureau implements protections for nearly all *Camissonia benitensis* occurrences, and has installed protective fencing or barriers around numerous occurrences and potential habitat. The Bureau should continue to implement protective measures for occurrences and potential habitat not currently protected, and to make the protection of newly discovered occurrences a priority.

#### **1.1 Close use areas that occur in proximity to *Camissonia benitensis* and special status species habitats on Bureau lands.**

Recreational travel occurs throughout the Clear Creek area, except in the San Benito Mountain Research Natural Area, which is closed to OHV use. Therefore, the Bureau should use trail signage to clearly mark closed areas, as needed. Patrols of closed areas should be

frequent enough to ensure sufficient compliance and minimize violations. To further protection of *Camissonia benitensis*, the Bureau recently closed the trail through the population near Indian Hill (suboccurrence #51100).

**1.1.1 Design and implement a plan for signing open and closed areas as needed to improve compliance.** OHV recreationists need to know the location of areas closed to them. The Bureau actively began signing in 2000, and the recently approved plan amendment further addresses this action. The 2006 CCMA plan amendment includes prioritization for closed route signage. Also, closed routes which travel through, or provide access to areas of concern will be signed, fenced and/or barricaded.

**1.1.2 Maintain signs.** Where the Bureau permits OHV recreation, signs should be inspected and maintained frequently enough to ensure users of the area are adequately informed. Bureau staff should maintain and update information about the condition of signage to aid in prioritization of maintenance and replacement activities.

**1.1.3 Close selected terrace sites to camping and OHV use.** Stream terrace sites comprise the principal habitat for *Camissonia benitensis*. In situations where camping and staging activities conflict with species protection, the Bureau should consider available alternatives including site closures. The Bureau should accompany any closures of camping or staging areas with interim signage and construction of vehicle barriers at the closed areas, as needed. Staging areas 1 and 5 in Clear Creek Canyon are a high priority for species protection and should have a high priority for closure because *Camissonia benitensis* recently colonized those sites.

**1.1.4 Continue to construct vehicle barriers, as necessary, around all existing *Camissonia benitensis* habitat on Bureau lands, including damaged terraces adjacent to open roads.** *Camissonia benitensis* habitat occurs along the road corridor in Clear Creek.

Because these roads continue to remain open to OHV use, OHV activities need to be appropriately restricted. Accordingly, the Bureau has corridor-fenced virtually all of the Clear Creek Canyon road corridor. Recovery of the species will likely require the continued protection of its occupied habitats and potential habitat polygons through additional installation of fencing or other types of vehicle barriers. The inclusion of potential habitat within fencing will allow occurrences of *Camissonia benitensis* to migrate through all usable areas adjacent to the current location of the population.

New fencing and barriers will likely be necessary for the habitat of recently discovered occurrences and any other moderate- to high-quality potential habitat areas of *Camissonia benitensis* discovered in the future. These sites should be protected in the following order of priority:

- A. Recently discovered occurrences and any other moderate-to high-quality potential habitat areas of *Camissonia benitensis* discovered in the future.
- B. Unoccupied sites that can serve for recovery actions and that need protection to prevent further degradation.
- C. Degraded sites should be evaluated for severity of damage to rank the immediacy of protection needed. Sites that show potential for restoration should be protected from additional degradation.

**1.1.5 Actively manage OHV closure zones with enforcement.** The Bureau should continue to develop and implement law enforcement procedures that ensure adequate public compliance with regulations designed to protect habitats and conserve populations of *Camissonia benitensis*.

**1.1.5.1 Ensure law enforcement staffing is adequate.** Current levels of law enforcement staffing should be commensurate with the size of the CCMA and the level of use it receives, to ensure that closures are enforced and that compliance monitoring is carried out.

**1.1.5.2 Develop enforcement procedures.** Continue to develop and implement improved law enforcement procedures that ensure adequate compliance with OHV trail and area closures to protect habitat for *Camissonia benitensis*.

**1.1.5.3 If public compliance with route and hillclimb closures is not achieved, the Bureau should develop contingency measures to protect *Camissonia benitensis*.**

If human activity continues to degrade the habitat of *Camissonia benitensis* despite the measures outlined in this plan, the Bureau should implement alternative or additional measures to effect the necessary protections. These measures could include increasing law enforcement capacity commensurate with non-compliance problems, or closing the principal entrances to the Clear Creek area or affected sites in the area until effective measures are implemented.

**1.2 Maintain a weed control program for the CCMA.** The Bureau has established a weed control program to ensure that highly invasive species, such as yellow star-thistle and medusahead, do not continue to spread in the CCMA. The control program includes mapping of existing occurrences of weed species, prescribed fire, mowing, removal, and monitoring. The Bureau coordinates these activities with existing groups that are working to address the problems in this region, and should ensure that the program is updated in the future, as necessary.

**1.3 Ensure protection of *Camissonia benitensis* on non-Bureau lands by establishing private landowner contacts.**

Protecting the four known occurrences on private lands, and others as yet undiscovered, is important for the continued persistence of this species. Contacting private landowners to enlist their voluntary assistance is one tool for preventing the inadvertent destruction of occurrences. With the assistance of the Bureau and a third party (such as the Natural Resources Conservation Service), the Service should inform landowners of the conservation needs of *Camissonia benitensis* and its habitat. If additional occurrences are discovered on private lands, owners should be contacted and informed as soon as possible.

**1.3.1 Develop informational materials for private lands.** The Service should use information developed for Action 5 about the distinctive biology and ecology of the San Benito mountain region to provide an explanatory synopsis of the ecology of *Camissonia benitensis* for neighboring landowners and the general public. Taylor's 1990, 1993, and 1995 reports to the Bureau document occurrences on Young Terrace (sub #111000), Sawmill Creek (sub #181100), and along Laguna Creek (sub #221100 and #241100) as occurring on private lands. The Service should develop a standard informational presentation to inform the landowners of the habitat requirements of *Camissonia benitensis*. The presentation should also include information about the Endangered Species Act and its intent. This outreach will help prevent additional damage or loss of occurrences and describe programs that provide assistance to landowners who want to undertake habitat restoration activities. If subsequent surveys reveal additional occurrences on private lands, educational materials should be presented to those landowners.

**1.3.2 Determine short-term and long-term goals for landowner land-use plans and model the effects of those uses on occurrences of *Camissonia benitensis*.** The Service should assist landowners in developing and implementing management plans that are beneficial to the species and acceptable to them. Because *Camissonia benitensis* occurrences are small and habitat is limited, landowners may be able to avoid incompatible land uses in those areas. Incentives to private

landowners, such as assistance for habitat restoration, should be identified where possible. Incentive plans should include prescriptions for grazing management, management of woody species, provisions to avoid detrimental land use practices, and monitoring key indicators of habitat health.

**1.3.3 Identify threats on private lands.** In conjunction with the Natural Resources Conservation Service, the Service should arrange to survey private land, with landowner permission, to evaluate land use practices and potential threats to extant occurrences of *Camissonia benitensis*.

**1.3.4 Develop and implement management plans for occurrences on private lands.** When landowners are willing, the Service should work with them to identify alternative and compatible activities to avoid adverse impacts and, where possible, protect extant occurrences. We should develop management plans that incorporate essential actions to protect the habitat and the species, and work with landowners to encourage the implementation of management plans.

**2. Reduce soil erosion and stream sedimentation above natural levels in watersheds that support habitat for *Camissonia benitensis* in the Clear Creek Management Area.**

Watersheds that support habitat for *Camissonia benitensis* and other species of concern should be protected from high levels of human-caused soil erosion and stream sedimentation (see section I.H.1.b above). The Bureau has developed guidelines for resource management in OHV areas on arid lands in cooperation with the California Department of Parks and Recreation (2002), and prepares annual corrective route maintenance plans to minimize impacts to watershed resources. The Bureau has also developed BMPs to address soil erosion, and conducts annual soil loss assessments. These activities should continue to be implemented, and BMPs should be updated as necessary.

**2.1 Establish an interagency technical team to assist in the development of a watershed management, protection , and restoration strategy, including soil erosion standards.**

Agency professionals (e.g., those working for the Environmental Protection Agency, the Natural Resource Conservation Service, and the State Water Resources Control Board) should be included in development of a strategy for managing soil loss, sedimentation, and water quality that includes specific standards for the watersheds supporting habitat for *Camissonia benitensis* and other sensitive species.

**2.2 Continue to identify and prioritize sites for restoration of *Camissonia benitensis* habitat.**

Some sites that are occupied by *Camissonia benitensis* or have suitable habitat may benefit from restoration activities. Restoration of some stream terrace sites severely damaged by camping and staging activities may be possible, but may not be practical given limited funding and time. Sites should be ranked with the highest priority for action given to those with the greatest potential for successful restoration and with the highest value to the species.

**2.3 Continue to monitor effectiveness of habitat management.**

The Bureau should regularly evaluate management actions to make timely corrections whenever monitoring indicates that resource loss or damage is occurring. The 2006 CCMA plan amendment includes monitoring for all sites which support *Camissonia benitensis* for incidents of OHV non-compliance, with the monitoring frequency based on the frequency of non-compliance. In the interest of improving the monitoring program, the Service and the Bureau should complete and finalize the draft compliance monitoring plan and continue to review the plan and associated results annually.

**2.3.1 Use aerial and ground photography to monitor landscape-scale changes over time.** Interpreting a time series of aerial

photography taken on regular flight paths is a key tool for monitoring effectiveness of management actions across rugged terrain, changes in the landscape over time (especially large erosion events), and changes in the cover of woody vegetation. The Bureau should continue periodic monitoring of standardized photo points on the ground.

**2.3.2 Compare photography to determine habitat conditions as related to user compliance.** The Bureau should analyze imagery periodically, as appropriate. Qualified staff (with backgrounds in geography, interpretation of aerial photography, or biology) should assess the conditions of closed areas designated to protect sensitive resources.

**2.3.3 Monitor soil loss, erosion, and sediment loading conditions in the five watersheds in the CCMA.** The Bureau should carry out a monitoring protocol developed as part of the watershed conservation strategy described in Action 2.1. The results of this monitoring should be used to better identify problem areas and to adjust management of those areas accordingly.

**3. Continue improvement and implementation of the management and monitoring plan for *Camissonia benitensis*.**

The Bureau should continue and improve *Camissonia benitensis* management by: a) continuing to review what is known about the life history of the species and its habitat requirements; b) supporting continued research into the species recovery needs; c) updating operating procedures for managing habitat for *Camissonia benitensis*, and d) updating compliance, habitat, and population monitoring protocols as needed.

**3.1 Use technical specialists to provide review and assistance in development and implementation of the monitoring and research programs.**

The technical specialists should include staff from the Bureau, the Service, and experts who have specialties in serpentine flora,

population viability, or the conservation of endemic plants. Technical specialists should work to ensure that existing monitoring protocols are appropriate, prioritize research needs, and make recommendations for other actions (such as introductions) that may be needed to recover the species.

### **3.2 Continue monitoring *Camissonia benitensis* occurrences.**

The Bureau should continue its existing annual monitoring program to determine the success of management activities and the status of the species. The monitoring program should cover any newly discovered colonies. The Bureau should also initiate additional monitoring of the dynamics of succession of woody vegetation to learn whether encroachment by shrubs reduces the quality and size of *Camissonia benitensis* habitats. Data should be collected and analyzed by trained and qualified biologists.

**3.2.1 Conduct annual population surveys.** The Bureau should continue spring surveys by qualified biologists based on the methods established by Taylor (1990) and Bureau biologists to maintain a long-term database to track population trends for this species. An understanding of the causes and frequency of local population extirpation, establishment, and connectivity among occurrences over space and time is essential to appropriately manage this narrow endemic. The Bureau should maintain and expand, as necessary, its geographic information system and relational databases linking spatial and attribute data as new occurrences are discovered.

### **3.2.2 Monitor woody vegetation on terrace sites where displacement of habitat for *Camissonia benitensis* is suspected.**

The Bureau should establish permanent plots using standard vegetation measurement techniques, and should monitor sites for changes in canopy cover of woody species, annually for at least 10 years to determine the rate, if any, of habitat displacement (Taylor 1990).

**3.2.3 Continue to update the protocol for using photo monitoring points as necessary.** A standardized system of establishing, permanently marking, and twice yearly monitoring of photo points was initiated by the Bureau in 1996. Based on the use of the system for several years, the Bureau should identify and document needed changes.

**3.3 Conduct additional research on the ecology and life history of *Camissonia benitensis*.**

Additional research on the ecology and life history attributes of *Camissonia benitensis* is needed to evaluate its recovery needs and to assist in the refinement of recovery criteria.

**3.3.1 Continue seedbank research.** Because *Camissonia benitensis* is an annual, the persistence of a given occurrence depends on its seedbank characteristics, including production, viability, germination triggers, dispersal mechanisms, and amount of viable seed persisting in the litter layer and the soil. The Bureau should study factors such as germination responses to weather patterns (light intensity, photoperiod, temperature fluctuations, moisture), physical abrasion of the seed coat, chemical influences on the seed coat, and habitat perturbations (landslides, floods, or fires). The Bureau should also develop a standardized method for measuring inter-annual variation in seedbank size and spatial variation in seedbank distribution. This research will assist us in understanding how the seedbank responds to natural conditions and how management actions might be used to ensure the persistence of a viable seedbank.

**3.3.2 Continue population introduction research.** The current number of occurrences may be too few for recovery of the species. The Bureau should support evaluation of the potential for augmenting occurrences and eventual benefits to the species from introductions. Although earlier attempts to introduce the species were not successful (Taylor 1993), additional attempts under different conditions or using newer techniques may result in success. As part of habitat surveys, the

Bureau should identify suitable unoccupied habitat for additional experimentation. An applied research program should be conducted if introductions are deemed to be of benefit to the long-term persistence of the species. Research should include investigations of different techniques for introduction and habitat management.

**3.3.3 Conduct research on terrace replacement rates.** Terrace succession rates are likely best measured in increments of decades. Terraces also erode away, either slowly over time, or suddenly with a catastrophic flood event. Research on terrace succession rates would provide information about how rapidly habitat for *Camissonia benitensis* is lost and created, and will be useful to include in the population modeling for this species.

**3.3.4 Construct population viability models.** Population models should be developed to assist us and the Bureau in developing appropriate delisting criteria. Habitat succession rate (old terraces eroding and new terraces forming), seedbank ecology, and population demographic parameters should be included in this effort.

**3.3.5 Conduct fire research.** Fire effects on *Camissonia benitensis* populations and habitats are unknown, and deserve careful research to understand the potential benefits and disadvantages of localized prescribed fire for long-term management for *Camissonia benitensis*. The Bureau should develop a research plan to address fire effects. While the asbestos contamination problem (see section I.D.2. above) makes large-scale use of prescribed fire difficult, it may be appropriate for the Bureau to use localized prescribed fire to reduce encroaching woody vegetation on terraces.

#### **3.4 Search for new occurrences on alluvial outwash habitat.**

The recent discovery of *Camissonia benitensis* on serpentine alluvial outwash has added a new habitat characteristic that has not been fully inventoried. Most of this type of habitat is on private lands and may be searched only with landowner permission. We and the Bureau

should seek the assistance of a third party (such as the Natural Resources Conservation Service) in making contact with landowners.

**3.5 Revise management based on monitoring and research results.**

Based on research findings, the Bureau should modify its management actions as necessary to provide improved ecological conditions for the recovery of *Camissonia benitensis* occurrences and habitats.

**4. Establish an *ex situ* seed collection.**

To have a hedge against extinction, and to provide a source of seed for future restoration and introduction efforts, the Bureau should establish a seed collection program. The program should include the collection of seed from all watersheds where *Camissonia benitensis* occurs, and, ideally, from every occurrence. The seed should be collected, tested, and stored by a botanic garden affiliated with the Center for Plant Conservation.

**5. Develop and implement a public awareness program for conserving *Camissonia benitensis* and its habitat.**

Because OHV recreation, especially within Clear Creek Canyon, poses a significant threat to *Camissonia benitensis*, a public awareness program that targets these users may be beneficial to the long-term survival of the species. This effort should focus on the threatened plant, but also on the unique plant communities, geology, and other rare species in the area.

**5.1 Install and maintain interpretive and informational signs near occurrences of *Camissonia benitensis*, and implement other interpretive activities**

Informing the public about the natural resources and associated concerns in the CCMA should include a variety of activities. For example, these efforts could include using CCMA interpreters to guide tours, and audio-visual presentations. Some canyon visitors will not participate in audio-visual programs or interpretive tours, and may not encounter Bureau staff.

Therefore, the Bureau should install signs near *Camissonia benitensis* occurrences that discuss the sensitive nature of the habitat within the enclosures, why the habitat needs to be protected, and other relevant natural history information.

**5.2 Continue to work with OHV and other user groups to conserve the Clear Creek Management Area and other habitat.**

The Bureau should enlist the assistance of OHV enthusiasts and other user groups as a means of gaining their cooperation with management efforts. The Bureau could establish a volunteer program to assist with habitat restoration projects. User group expertise may be helpful for developing appropriate signs, potential user fee programs, and effective closures.

**Table 9.** Cross-reference of recovery actions, listing factors and threats.

<b>Threat (Listing Factor)</b>	<b>Recovery Actions (Action #)</b>	<b>Recovery Criteria</b>
Habitat destruction from OHV and other recreational use. (A)	Design, implement a signing plan (1.1.1); maintain signs (1.1.2); Close selected terrace sites to camping and OHV use (1.1.3); Construct barriers around all <i>Camissonia benitensis</i> populations and habitat (1.1.4); manage OHV closure zones with enforcement (1.1.5); monitor <i>Camissonia benitensis</i> occurrences (3.2); provide public interpretation (5.1); conduct interpretive tours (5.2); install interpretive signs (5.3); work cooperatively with user groups (5.4)	2, 3, 4
Habitat alteration due to soil loss and elevated rates of erosion. (A)	Establish a team to assist in development of a watershed management strategy, including soil erosion standards (2.1); Identify and prioritize sites for restoration (2.2); Monitor effectiveness of habitat management (2.3) Conduct research on terrace replacement rates (3.3.3).	1, 2, 3, 4
Habitat alteration and destruction due to construction and maintenance activities. (A)	The Administrative Site is being considered for closure. Other Bureau construction activities will be subject to NEPA review. Establish a team to assist in development of a watershed management strategy (2.1).	2, 3, 4
Habitat alteration and destruction due to mining activities. (A)	Almost all mining activity has ceased as of 2003. Mining reclamation plans need to be reviewed and approved by the Bureau for sites on Bureau lands.	2, 3, 4
Habitat alteration due to invasive species. (A)	Establish and maintain a weed control program for the CCMA (1.1.6).	1, 3
Inadequate regulatory mechanisms. (D)	Close selected terrace sites to camping and OHV use (1.1.3); construct barriers around all <i>Camissonia benitensis</i> populations and habitat (1.1.4); manage OHV closure zones with enforcement (1.1.5); conduct annual population surveys (3.2.1);	5
Succession to woody shrub community on terraces. (E)	Monitor woody vegetation on terrace sites (3.2.2); Update the protocol for using photo monitoring points (3.2.3); conduct fire research (3.3.5).	1, 3
Small population size, stochasticity. (E)	Ensure protection of <i>Camissonia benitensis</i> on private lands through landowner programs (1.2); assemble technical team to oversee monitoring and research programs (3.1); monitor <i>Camissonia benitensis</i> occurrences (3.2); conduct additional research on the ecology and life history of <i>Camissonia benitensis</i> (3.3); conduct research on seedbanks (3.3.1); conduct population introduction research (3.3.2); conduct research on terrace replacement rates (3.3.3); construct viability models (3.3.4); conduct fire research (3.3.5); search for new occurrences (3.4); establish <i>ex situ</i> seedbank in appropriate CPC facility (4).	1, 4

## V. IMPLEMENTATION SCHEDULE

The table that follows is a summary of scheduled actions and costs for the *Camissonia benitensis* recovery plan. It is a guide for meeting the objectives discussed in Part II of this plan. The table includes the following five elements, which are further discussed below: 1) the action priority; 2) the action number and description; 3) the action duration; 4) agencies responsible for performing actions; and 5) cost estimates.

**A. Recovery Action Priorities.** The actions identified in the Implementation Schedule are those that should promote the recovery of this species. However, the actions are subject to modification based on new findings, changes in species status, and the completion of recovery actions. The priority for each action is given in the first column of the implementation schedule; we assign priorities as follows:

- Priority 1: An action that must be taken to prevent extinction or to prevent the species from declining irreversibly in the foreseeable future.
- Priority 2: An action that must be taken to prevent a significant decline in species population or habitat quality or some other significant negative impact short of extinction.
- Priority 3: All other actions necessary to provide for full recovery of the species.

**B. Action Number and Description.** The action number and description correspond to elements in the recovery action narrative in Part III of the recovery plan. Refer to this narrative for a detailed description of each action.

**C. Action Duration.** The action duration column indicates whether the action is discrete (includes the number of years estimated to complete it), or ongoing (currently being implemented and will continue until it is no longer necessary for recovery).

**D. Responsible Parties.** We have identified agencies and other parties that are primary stakeholders in the recovery process. Potential stakeholders are not limited to the list below; we invite others to participate. For some actions, the responsible party assumes all responsibilities for implementation; for other actions, a group effort is appropriate. The following abbreviations are used to identify primary stakeholders for each recovery action:

BLM = U.S. Bureau of Land Management

CPC = Center for Plant Conservation

CSB = County of San Benito

CSWRB = California State Water Resources Board

NRCS = Natural Resources Conservation Service

UC = University of California or other academic institution

FWS = U.S. Fish and Wildlife Service

**E. Cost Estimates.** The estimated costs are shown for recovery actions for the first 5 years; achieving recovery will likely involve additional costs in an unknown number of additional years in the future. The estimated costs include estimated salaries for individuals who would carry out the identified task. Typically, the lead agency assumes the largest share of the cost. Other stakeholders are sometimes shown as contributors. For actions that continue past 2010 or are ongoing, the total cost is greater than the sum of the costs shown for the first 5 years; projected total cost for recovery is estimated over a 50-year timeframe for ongoing actions. The inclusion of estimated costs in this recovery plan does not commit any agency or party to an expenditure of funds. Therefore, initiation and completion of these actions is subject to the availability of funds, as well as other constraints affecting the stakeholders involved.

## Implementation Schedule for *Camissonia benitensis* Recovery Plan

Action Priority	Action Number	Action Description	Action Duration (years)	Responsible Parties	Estimated Costs (1,000)					
					Total Cost	2006	2007	2008	2009	2010
Recovery Action 1: Protect known occurrences and suitable habitat for <i>Camissonia benitensis</i> in the CCMA.										
1	1.1.1	Design and implement signing plan for open and closed areas for OHV use.	1	BLM	50	50	0	0	0	0
1	1.1.2	Maintain signs.	Ongoing	BLM	40	20	5	5	5	5
1	1.1.3	Close selected terrace sites to camping.	1	BLM	25	25	0	0	0	0
1	1.1.4	Continue barrier construction at <i>Camissonia benitensis</i> habitat.	2	BLM	20	10	10	0	0	0
1	1.1.5.1	Ensure law enforcement staff is adequate.	5	BLM	200	40	40	40	40	40
1	1.1.5.2	Develop enforcement procedures.	5	BLM	50	10	10	10	10	10
1	1.1.5.3	If public compliance is lacking, develop contingency measures.	Ongoing	BLM	50	10	10	10	10	10
1	1.2	Establish and maintain a weed control program.	Ongoing	BLM CSB	10 10	2 2	2 2	2 2	2 2	2 2
3	1.3.1	Develop informational materials for private landowners.	5	FWS	10	5	5	0	0	0
3	1.3.2	Determine land-use goals for private lands within <i>Camissonia benitensis</i> habitat.	3	FWS NRCS	6	0	0	2	2	2
3	1.3.3	Survey private parcels to identify threats to <i>Camissonia benitensis</i> populations.	4	FWS NRCS	9	0	0	3	3	3
3	1.3.4	Develop and implement management plans for private lands with <i>Camissonia benitensis</i> .	4	FWS NRCS	10	0	0	0	5	5

Action Priority	Action Number	Action Description	Action Duration (years)	Responsible Parties	Estimated Costs (1,000)					
					Total Cost	2006	2007	2008	2009	2010
Subtotal					490	174	84	74	79	79
Recovery Action 2: Reduce or eliminate soil erosion and stream sedimentation above natural levels in watersheds that support <i>Camissonia benitensis</i> in the CCMA.										
2	2.1	Use interagency technical expertise to develop watershed management strategy.	5	FWS BLM NRCS CSWRB	10 5 5 5	2 1 1 1	2 1 1 1	2 1 1 1	2 1 1 1	2 1 1 1
2	2.2	Continue to identify and prioritize sites for restoration of <i>Camissonia benitensis</i> habitat.	10	FWS BLM NRCS CSWRB	15 2 2 2	0 0 0 0	0 0 0 0	5 1 1 1	5 1 1 1	5 0 0 0
2	2.3	Continue to monitor effectiveness of habitat management.	5	FWS BLM	3 3	0 0	0 0	1 1	1 1	1 1
2	2.3.1	Use photography to monitor landscape-scale changes over time.	Ongoing	BLM FWS	5	1	1	1	1	1
2	2.3.2	Compare photography to determine user compliance.	Ongoing	BLM	5	1	1	1	1	1
2	2.3.3	Monitor soil loss from the 5 watersheds in the CCMA.	Ongoing	BLM CSWRB NRCS	25	5	5	5	5	5
Subtotal					87	12	12	22	22	19
Recovery Action 3: Develop and Implement a species management strategy, including monitoring, for <i>Camissonia benitensis</i> .										
2	3.1	Use of technical specialists to assist in implementation of monitoring and research needs for <i>Camissonia benitensis</i> .	5	BLM FWS UC	5 5	1 1	1 1	1 1	1 1	1 1

Action Priority	Action Number	Action Description	Action Duration (years)	Responsible Parties	Estimated Costs (1,000)					
					Total Cost	2006	2007	2008	2009	2010
2	3.2.1	Conduct annual population surveys.	5	BLM UC	25	5	5	5	5	5
2	3.2.2	Monitor woody vegetation on terrace sites.	5	BLM UC	5	1	1	1	1	1
2	3.2.3	Revise photo monitoring point protocol.	5	BLM	10	2	2	2	2	2
2	3.3.1	Continue seedbank research.	5	BLM UC CPC	12	0	3	3	3	3
2	3.3.2	Continue population introduction research.	5	BLM UC FWS	15	0	0	5	5	5
2	3.3.3	Conduct research on terrace replacement rates.	3	BLM UC NRCS	15	0	5	5	5	0
2	3.3.4	Construct population viability models.	3	BLM FWS UC	15	0	0	5	5	5
2	3.3.5	Conduct fire research.	5	BLM UC	9	0	0	3	3	3
2	3.4	Search for additional occurrences.	5	BLM FWS	15	0	0	5	5	5
2	3.5	Revise management based on monitoring and research results.	Ongoing	BLM	tbd	tbd	tbd	tbd	tbd	tbd
Subtotal					131	10	18	36	36	31
Recovery Action 4: Establish an <i>ex situ</i> seed collection.										

Action Priority	Action Number	Action Description	Action Duration (years)	Responsible Parties	Estimated Costs (1,000)					
					Total Cost	2006	2007	2008	2009	2010
3	4	Establish ex situ seed collection.	5	FWS CPC	10	2	2	2	2	2
<b>Subtotal</b>					<b>10</b>	<b>2</b>	<b>2</b>	<b>2</b>	<b>2</b>	<b>2</b>
<b>Recovery Action 5: Develop and implement a public awareness program for conserving <i>Camissonia benitensis</i> and its habitat.</b>										
3	5.1	Install and maintain interpretive signs, and implement other interpretive activities.	Ongoing	BLM	43	7	12	8	8	8
3	5.2	Work with OHV and other user groups to conserve habitat.	Ongoing	BLM	17	0	8	3	3	3
<b>Subtotal</b>					<b>60</b>	<b>7</b>	<b>20</b>	<b>11</b>	<b>11</b>	<b>11</b>
<b>Total estimated cost for the first 5 years</b>					<b>778</b>	<b>205</b>	<b>136</b>	<b>145</b>	<b>128</b>	<b>142</b>
<b>Projected cost of recovery (estimated over 50-year timeframe): \$2,438,000</b>										

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## APPENDIX A. EXPLANATION OF THE RECOVERY PRIORITY SYSTEM

The Recovery Priority System uses the criteria of degree of threat, recovery potential, and taxonomy (level of genetic distinctiveness) to assign all listed species a number (1-18). A fourth factor, conflict, is a supplementary element in determining what actions are to be implemented for species recovery. This factor gives priority, within each category, in preparation of recovery plans to species that are, or may be in conflict with construction or development projects. Thus, the species retains its numerical rank and acquires the letter designation of "C", indicating conflict (1C-18C). A detailed discussion of the Recovery Priority System can be found in Federal Register 48:51985.

Degree of Threat	Recovery Potential	Taxonomy	Priority	Conflict
High	High	Monotypic genus	1	1C
	High	Species	2	1 2C
	High	Subspecies	3	2 3C
	Low	Monotypic genus	4	3 4C
	Low	Species	5	4 5C
	Low	Subspecies	6	5 6C
Moderate	High	Monotypic genus	7	6 7C
	High	Species	8	7 8C
	High	Subspecies	9	8 9C
	Low	Monotypic genus	10	9 10C
	Low	Species	11	10 11C
	Low	Subspecies	12	11 12C
Low	High	Monotypic genus	13	12 13C
	High	Species	14	13 14C
	High	Subspecies	15	14 15C
	Low	Monotypic genus	16	15 16C
	Low	Species	17	16 17C
	Low	Subspecies	18	17 18C

## APPENDIX B. ANNUAL POPULATION TOTALS OF *CAMISSONIA BENITENSIS*

This table uses the old and new methods of site numbering. Populations at Sites 1C, 7, 16, and 17 are introduction attempts. Data from Taylor (1990, 1991, 1993, 1995) and Bureau of Land Management (1997b, 1998, 1999, 2000, 2001, 2002a, 2003, 2004a, 2005a, and 2006b). Populations were not censused in 1995. Surveys in 2006 were limited by adverse weather (Bureau of Land Management 2006) and may not be representative.

Watershed	Site #	Sub-occ	1987	1988	1989	1990	1991	1992	1993	1994	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
Clear Creek	1B	11100		18691	921	84	85	400	419	100	800	12	1052	0	1128	0	30	375	28	700	0
Clear Creek	2.1	21100									3	0	5	0	0	0		10	0	15	10
Clear Creek	2	21200	0	1540	0	0	180	354	1158	0	50	8	64	200	11	80	20	45	24	600	0
Clear Creek	2.3	21300									3600	67	635	12	0	25		230	0	150	0
Clear Creek	2.4	21400									150	47	102	0	1000	80		26	15	500	30
Clear Creek	-	21500																			
Clear Creek	3	31100	0	672	0	0	2	29	4	0	100	0	22	0	1000	0	200	70	35	100	20
Clear Creek	4	41100	2	357	27	0	0	82	303	27	80	23	598	0	346	15	80	122	30	1660	0
Clear Creek	16	41200						16	5	21	81	0	244	0	0	0	0	0	0	0	0
Clear Creek	-	41300													0	75					
Clear Creek	-	41400													0	0					
Clear Creek	6	51100	1	5976	0	0	422	163	200	12	600	229	853	49	110	75	600	1500	7	5000	0
Clear Creek	5	51200	112	133507	357	44	4450	28000	575	133	960	52	2174	50	2634	200	200	7500	20	10000	0
Clear Creek	-	51300									14	16	154	0	419	0	0	25	20	50	0
Clear Creek	7	51400	0	0	0	0	0	28	15	0	40	3	241	0	553	0	75	200	0	0	0
Clear Creek	17	51500						3	0	0	75	34	53	30		0	36	0	0	0	0
Clear Creek	8	81100	0	27	0	0	0	40	11	38	8	1	16	0	105	65	3	1500	20	43	0
Clear Creek	8.5	81200									211	84	178	0	0	100	98	35	30	11	0
Clear Creek	14	141100			9	5	7	96	29	0	10	0	0	0	0	0	0	0	0	0	0
Clear Creek	-	251100									28	92	186	0	13	72		135	15	296	0
Clear Creek	1C	281100	0	0	0	0	0	147	15	0	3	7	60	0	0	0	0	0	0	20	0
Laguna	22	221100						125	0							0					

Watershed	Site #	Sub-occ	1987	1988	1989	1990	1991	1992	1993	1994	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
Laguna	24	241100								175											
Larios	-	61100											2000	60	50	0	775	34	25	107	14
Larios	-	61200													25	0	67	10	0	30	0
Lorenzo Vasquez	15	151100					21	149	0	0											
Lorenzo Vasquez	19	191100						400	1459	281		160	708	0		3	80	120		500	
San Benito/ Clear Crk Confluence	11	111100			16	1	40	128	125	0	100	6	32	1		10	30	48	38	2500	0
San Benito/ Clear Crk Confluence	-	291100									90	4	287	0	750	176	260	215	5	2500	25
San Benito/ Clear Crk Confluence	-	291200									4	0	5	0	55	0	0	55		860	7
San Benito/ Clear Crk Confluence	1	291300							5	4	0	0	76	5		0	0	23		280	12
San Benito/ Clear Crk Confluence	-	291400														0	16			860	0
San Benito/ Clear Crk Confluence	-	291500														0	27			120	0
San Carlos	9	91100	149	4398	247	12	0	1355	318	50	400	465	651	120	3000	430	1420	1455	100	13077	100
San Carlos	9.2	91200									90	100	77	24	300	35	30	75	20	90	12
Upper Clear Creek	12	121100			3	0	0	8	0	0	100	3	37	16	1476	20	150	0	0	14	0
Upper Clear Creek	23	122100							65	16	210	27	190	0	33	100	10	175	0	0	0
Upper San Benito	-	71100											50		24	0		43		210	
Upper San Benito	-	71200											9		896	0		50		190	
Upper San Benito	-	71300											300		300	0	280	435		0	
Upper San Benito	-	71400											20		122	0		350		0	

	Watershed	Site #	Sub-occ	1987	1988	1989	1990	1991	1992	1993	1994	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
	Upper San Benito	10	101100			102	0	0	475	212	20	1100	21	188	0	0	70	66	125	15	100	30
	Upper San Benito	13	131100			21	0	0	12	8	0	18	0	0	0	0	0	0	0	0	0	0
	Upper San Benito	-	161100											130		0	60		0			
	Upper San Benito	-	161200											250		2	78		16			0
	Upper San Benito	18	181110						101	0	0	0	0	0	0	500	0	0	0			0
	Upper San Benito		261100									880	89	83	0	820	60	300	83	50	70	0
	Upper San Benito	-	271100									110	22	188	0	619	20	15	23	30	150	24
	White Creek	20	201100						88	112	1	180	29	706	20	65	25	40	64	50	130	0
	White Creek	21	201200						9	54	0	170	5	207	30	78	50	50	70	0	50	0
	White Creek	-	201300									8	0	12	8	53	0	0	43	30	210	0
	White Creek	-	201400													267	0	175	0	0	200	0
	White Creek	-	201500													6	0	0	1200	0	150	0
	Total			264	165168	1703	146	5207	32208	5092	878	10273	1606	12843	625	16760	1924	5133	16485	607	41543	284

## **APPENDIX C. CHRONOLOGY OF BUREAU OF LAND MANAGEMENT ACTIVITIES IN THE CLEAR CREEK MANAGEMENT AREA**

Since 1985, measures have been taken to conserve and protect *Camissonia benitensis*. These measures are summarized here chronologically by type of activity.

### Land Use Designations and Decision Documents:

- 1990-1994 The Bureau acquired 520 acres along lower Clear Creek up to and including its confluence with the San Benito River to protect riparian and *Camissonia benitensis* habitat. The acquisitions placed seven suboccurrences under Bureau management. Most of the length of this reach has been protected by fencing.
- 1995 The Bureau published the CCMA Management Plan and final Environmental Impact Statement that evaluated management objectives for the next 15 years in the 30,000-acre Serpentine Area of Critical Environmental Concern (ACEC).
- 1995 A biological evaluation for the current and proposed expansion of the Bureau's administrative facilities was completed by the Bureau and included provisions for mitigation for impacts to, and ongoing monitoring for, *Camissonia benitensis*.
- 1997 The Service published a Biological Opinion on the Bureau's management of Clear Creek and the Administrative Site (see text for more information).
- 1999 The Bureau published its Record of Decision on the CCMA Management Plan.
- 2004 The Bureau published a Draft Clear Creek Management Area Plan Amendment and Draft Environmental Impact Statement.
- 2005 The Bureau published the Clear Creek Management Area Proposed Resource Management Plan Amendment and Final Environmental Impact Statement
- 2006 The Bureau published the Record of Decision for the Resource Management Plan Amendment for the Clear Creek Management Area.

#### OHV and Recreation Management:

- 1988 The Bureau built a new Administrative Site to increase presence in the field and to make its management more efficient.
- 1993 The Bureau assigned a full-time, permanent law enforcement officer to the Administrative Site.
- 1993 The Bureau contracted PTI Environmental Services to develop a watershed model for the Clear Creek watershed that estimated soil loss and erosion.
- 1995 Pacific Watershed Associates inventoried 110 miles of most-used routes and prescribed actions to reduce road related erosion and sediment delivery.
- 1996 The Bureau began a baseline inventory of potential habitat polygons for *Camissonia benitensis* upon which to recommend protection measures, and established 60 permanent photopoints in occupied areas.
- 1996- The Bureau hired a crew to build and maintain protective fences around  
1998 potential habitat polygons and terraces occupied by *Camissonia benitensis*, and around riparian zones.
- 1996 The Bureau started compliance monitoring on a monthly basis from October to May, and bimonthly from June to September, to allow timely reporting of problems to managers so that corrective action could be taken.
- 1996 The Bureau developed and implemented a Programmatic Environmental Analysis for recurring road maintenance to avoid sensitive resources while improving road drainage and reducing sediment delivery.
- 1996 Sign installation continued and encouraged OHV use on well-maintained routes and destinations that are not near sensitive resources.
- 1996 The Bureau began a program to use volunteers to greet OHV users at the mouth of Clear Creek during special OHV events to explain how compliance with protective closures was critical to maintaining an OHV recreational opportunity at Clear Creek.
- 1996 The Bureau began including terraces identified by Taylor (1990) as potential habitat in its resource protection activities.
- 1997- The Bureau installed up to 30 miles of fencing throughout the CCMA to

- 1998 protect sensitive vegetation communities and rare plant species.
- 2000 The Bureau installed 4 gates for wet-season closure, 2 at the entrances to CCMA, and 2 on either end of Sawmill Creek road. Five additional gates were installed on the primary routes leading out of Clear Creek Canyon.
- 2003 The Bureau installed pipe-barrier fencing around all OHV-accessible vernal pools at Spanish Lakes.
- 2003 The Bureau implemented an Emergency Closure of approximately 5 acres on Larious tributary to protect *Camissonia benitensis* on November 26, 2003. As of January 2005, the area remains closed.
- 2004 The Bureau hired two seasonal park rangers to assist with OHV compliance monitoring and ongoing facilities maintenance in the CCMA.
- 2004 The Bureau placed a visitor station near the entrance of the CCMA. The station is staffed on weekends by the Bureau.
- 2004 The Bureau installed protective fencing around occupied and potential habitat for *Camissonia benitensis* in Upper Clear Creek Canyon. Assistance was contributed by OHV recreationists, and members of the California Native Plant Society and the Sierra Club.

Planned Activities:

- 2005 Several staging areas will be converted to “day use only,” and recreationists will be encouraged to camp at existing designated sites outside of the serpentine zone.

Biological Research and Monitoring:

- 1988 The Bureau funded life history studies by Dr. Dean Taylor, 1988 through 1995.
- 1988- Taylor attempted *Camissonia benitensis* reintroductions with broadcast  
1992 seed.
- 1990 The Bureau hired a full-time, permanent botanist to assist with inventory and monitoring of rare plant populations.
- 1997 The Bureau began a focused inventory of *Layia discoidea* (rayless layia), another plant of serpentine soils in the CCMA.

- 1997 The Bureau hired Dynamac Corporation to evaluate the rates of soil erosion and sedimentation taking place within serpentine soil barrens and the extent to which these rates are influenced by human activities, and to develop an inventory and ranking system in advance of open area designation (Dynamac 1998).
- 1997- The Bureau initiated monthly compliance monitoring during the use  
2005 season to track impacts from recreational activity at all occupied and suitable habitat sites for *Camissonia benitensis*.
- 2005 The Bureau initiated an annual population census at all potential and occupied *Camissonia benitensis* sites.
- 2003 The California Department of Fish and Game and the California Native Plant Society conducted targeted vegetation mapping of the Clear Creek Management Area in preparation of rare plant surveys to be conducted in 2005-2006.
- 2004 The Bureau's Hollister Field Office received \$60,000 in grants from the Bureau's National Science Initiative program to design and implement a rare plant inventory and monitoring program for the CCMA.
- 2004 The Bureau contracted Xeric Specialties to conduct vernal pool fairy shrimp sampling. One species, *Linderiella occidentalis*, was identified in three of the four vernal pools.

## **APPENDIX D. SUMMARY OF PUBLIC, AGENCY, AND PEER REVIEW COMMENTS ON THE DRAFT RECOVERY PLAN**

**Public Review:** On February 2, 1999, we released the draft recovery plan for *Camissonia benitensis* for a 60-day comment period that ended on April 5, 1999, for all interested agencies and members of the public (U.S. Fish and Wildlife Service 1999). Copies of the draft recovery plan were sent to approximately 50 interested parties. No comments were received from the public during this review period.

**Agency Review:** From the time that we first initiated a draft recovery plan in 1988, to the time that the draft recovery plan was finally published in 1999, we coordinated with the Bureau of Land Management in its development. Bureau staff reviewed numerous versions of the draft plan and many of their comments were incorporated into the published document. In addition, the Bureau supplied extensive background information for the development of the final plan, and Bureau staff in the Hollister Field Office and the State Office made numerous comments on the final plan. Because Bureau comments have for the most part been incorporated into the plan, we have not identified any agency comments in the review below.

**Peer Review:** In 1994, we published a policy of requesting peer review of draft recovery plans and our other documents (Federal Register 59:34270). However, since guidance on implementing this policy was not immediately available, we did not seek peer review on the draft recovery plan. We requested peer review of the final recovery plan during its final stages of development in 2003. Peer reviewers are typically selected for their familiarity with the taxonomic group, a geographic area or ecosystem, or familiarity with principles of conservation biology. We requested peer review from four individuals, all of whom responded.

### **Summary of Significant Comments and Our Responses**

We reviewed all of the comments received from the Bureau and from the four peer reviewers. Comments that were editorial or technical in nature or were updating the information in the draft recovery plan have been incorporated into the appropriate sections of the recovery plan. We have summarized the most substantial issues that were raised by the peer reviewers.

**Comment:** All of the peer reviewers had concerns about the Bureau's ability to implement actions from the recovery plan. The concerns included the Bureau's lack of funding, lack of law enforcement staff, the ability to implement actions in a timely fashion, and the ability to carry out effective public education. Because so much of

the habitat for *Camissonia benitensis* occurs on Bureau lands, the conservation and recovery of the species relies to a great extent on successful implementation of recovery actions by the Bureau.

Response: We greatly expanded the level of detail of information presented in the final recovery plan to assist the Bureau with its planning efforts. This included identifying needed recovery actions, prioritizing those actions, identifying opportunities to partner with other agencies and non-governmental organizations, and providing estimated costs and timeframes in the Implementation Schedule. While nothing in the recovery plan binds the Bureau to funding and completing recovery tasks, we hope that the publication of this plan will assist all interested parties in working with the Bureau to assist in successful implementation of recovery tasks.

Comment: Several peer reviewers commented about the importance of seedbanks to the persistence of annual species such as *Camissonia benitensis*. Specific suggestions included: having a more complete summary of Taylor's seedbank research, specifying additional needed seedbank research, developing a standardized method for measuring inter-annual variation in seedbank size and spatial variation in seedbank distribution, and investigating how weather patterns affect dormancy and germination.

Response: We added additional information about Taylor's seedbank research in the background section under Life History, and more detail to the section on needed seedbank research in the Narrative Outline section.

Comment: One peer reviewer suggested that, given the extent of human impacts on the habitat of *Camissonia benitensis*, it would be useful to do a spatial analysis of the locations of sensitive species and habitats and where human impacts are occurring to assist with management decisions.

Response: We agree that additional analyses of sensitive species locations and habitats would be useful to further conservation efforts for these species.

Comment: The California Native Plant Society provided a recommended prioritization of various management actions. Actions under the sole control of the Bureau that provide direct protection of *Camissonia benitensis* and its habitat, and monitoring that assists managers in determining the success of implementation, are of highest priority. Actions involving other parties (e.g., private

landowners) and research have a lower priority. Research actions focused on soil erosion rates and their effects on the stability of *Camissonia benitensis* habitat are of higher priority than other research actions.

Response: We agree that actions that protect the species and its habitat are of highest priority, and this is reflected in the assignment of priority numbers (1, 2, or 3) to the tasks in the Implementation Plan. We also agree that research related to soil erosion rates is important to protection of habitat. We anticipate technical specialists will assist with oversight of the monitoring and research programs (see Task 3.1).

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